

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Marlene M. DARFLER., et al.) Confirmation No: 9373
)
Application Serial No.: 10/796,288) Group Art Unit: 1657
)
Filed: March 10, 2004) Examiner: Kailash Srivastava, Ph.D.

For: LIQUID TISSUE PREPARATION FROM HISTOPATHOLOGICALLY
PROCESSED BIOLOGICALLY SAMPLES, TISSUES AND CELLS

United States Patent and Trademark Office
Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Declaration under 37 C.F.R. § 1.132

I, Dr. Anirban Maitra, declare and say:

1. I am an Associate Professor of Pathology and Oncology at the Sol Goldman Pancreatic Cancer Research Center, Johns Hopkins University School of Medicine. I am also Editor-in-Chief of the scientific journal *Current Molecular Medicine*.
2. A copy of my *Curriculum Vitae* is appended below as APPENDIX A.
3. I make the following statement regarding the use of organic solvents for the removal of paraffin from standard tissue sections and the use of the term "organic solvents" in reference to an entire collection of reagents well known to those skilled in the art and science of pathology.
4. Paraffin has been used for many decades as an embedding medium in the preparation of tissue specimens for sectioning in a microtome to produce specimen sections for histological studies. Such embedding processes are well known in the field and generally include the well known steps of: specimen fixation; dehydration; clearing; paraffin infiltration or impregnation; embedding in a block of paraffin; slicing the block and specimen into sections; mounting the sections on slides; removing the paraffin with organic solvents employed for this purpose (deparaffinizing); and staining the sections prior to microscopic analysis.
5. Fixation is performed to preserve the structure of the tissue. This process provides rigidity to the tissue, making it easier to section. Common fixatives used include formalin and glutaraldehyde. Once placed in the fixative, covalent bonds are formed between the fixative and the amine groups of the tissue proteins, cross-linking the proteins. Once fixation has been completed, the sample is embedded prior to sectioning. The primary purpose of the embedding

medium is to permit the specimens to be sectioned and mounted on glass slides in their natural state, and removal of paraffin by organic solvents is necessary for further histological analysis.

6. Xylene is the most commonly used organic solvent to solubilize paraffin for deparaffinization of specimen sections, however, other organic solvents that have been used in the past or are currently used for removal of paraffin from thin tissue sections include chloroform, benzene, toluene, hexane, and heptanes. The physical and chemical properties of organic solvents used to solubilize paraffin for deparaffinization of samples would have been well known one having ordinary skill in the art at the time the captioned application was filed. For example, the solvent should be sufficiently non-polar to dissolve paraffin without causing chemical damage to the tissue proteins.

7. In a typical process, a microscope slide-mounted specimen is immersed in a xylene bath until the paraffin is solubilized. The deparaffinized specimen is then washed with a series of alcohol solutions of decreasing alcohol concentration, typically as baths in which the specimen is immersed, to remove xylene, before a final wash with water. The nature and identity of a wide variety of organic solvents that are used for paraffin removal from tissue sections are well known to those skilled in the art, and the use of the term "organic solvents" to describe an entire collection of reagents for removal of paraffin from tissue sections is well understood by those skilled in the art.

8. Drip column fractionation is a term that is in common usage in biochemical and chemical research, and its meaning is clearly understood in the art. Specifically, the term refers to a method of separating molecules, such as proteins, by passing a liquid sample containing the molecules to be separated down a column containing a separation medium, such as an ion-exchange resin, and collecting the eluate that drips from the column. The different molecules present in the sample bind to the separation medium to a differing degree and therefore elute from the column in different fractions. I have appended four excerpts from the scientific literature that refer to drip column techniques (see APPENDIX B) used by chemists and biochemists to separate samples. These excerpts clearly demonstrate that the term "drip column fractionation" has a clear meaning in the art.

9. Reference #1 describes drip columns in the last paragraph of Section 2:

"If a drip column format is used, the displacer is allowed to pass into the column bed and the flow is then halted (e.g. by capping the column outlet). After a period of equilibration (15-30 minutes) the dissociated proteins are flushed out by application of more elution buffer. This step can be repeated until protein is absent from the eluted fractions."

10. Reference #2, US Patent 5,336,412 in the Background of the Invention refers to "Conventional gel-chromatography "drip" columns..."

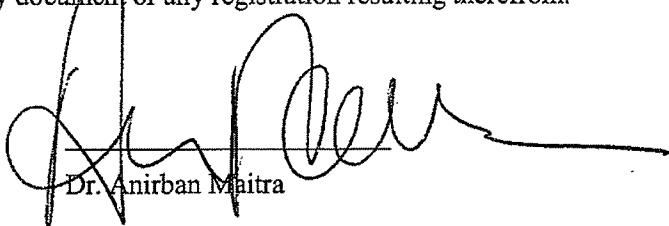
11. Reference #3 is a commercial catalog that states:

"The easy-to-use Zeba Spin Format dramatically improves results over standard drip-column methodologies, eliminating the need to wait for samples to emerge by gravity flow and the need to monitor fractions for protein recovery."

12. Reference #4 is an excerpt from the book "CDNA Library Protocols" by Ian G. Cowell and Caroline A. Austin (Humana Press, 1996, ISBN:089603383X) that describes drip column preparation.

13. All statements made herein of my knowledge are true and all statements made on information and belief are believed to be true; and further, these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any document or any registration resulting therefrom.

Date: 08/14/08



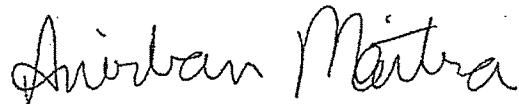
A handwritten signature in black ink, appearing to read "Dr. Anirban Maitra". The signature is fluid and cursive, with a large, stylized initial 'A' at the beginning.

Dr. Anirban Maitra

APPENDIX A

Curriculum Vitae – Anirban Maitra

CURRICULUM VITAE



ANIRBAN MAITRA, M.B.B.S.

DEMOGRAPHIC INFORMATION

Current Appointments:

University: Associate Professor of Pathology
Associate Professor of Oncology (secondary)
Affiliate, McKusick-Nathans Institute of Genetic Medicine

Hospital: Pathologist, The Johns Hopkins Hospital

Personal Data:

Business Address: CRB-2 Room 345
1550 Orleans Street
Baltimore, MD 21231
Phone 410 502 8191
Fax 410 614 0671
Email amaitral@jhmi.edu

Education and Training:

1990-1996 Bachelor of Medicine, Bachelor of Surgery (MBBS), All Indian Institute of Medical Sciences, New Delhi, India
1996-1998 Residency in Anatomic Pathology, University of Texas Southwestern Medical Center, Dallas
1998-1999 Research Fellow, Molecular Pathology, University of Texas Southwestern Medical Center, Dallas
1999-2000 Clinical Fellow, Pediatric Pathology, University of Texas Southwestern Medical Center, Dallas
1999-2001 Residency in Anatomic Pathology, University of Texas Southwestern Medical Center, Dallas
2000-2001 Clinical/Research Fellow, Gastrointestinal Pathology, Johns Hopkins University School of Medicine, Baltimore.

Professional Experience:

2002-2003 Instructor, Gastrointestinal Pathology, Johns Hopkins University School of Med, Baltimore.
2002- Affiliate, McKusick-Nathans Institute of Genetic Medicine, Johns Hopkins Univ., Baltimore
2003-2005 Assistant Prof, Pathology, Johns Hopkins University School of Medicine, Baltimore.
2003-2005 Assistant Prof, Oncology, Johns Hopkins University School of Medicine, Baltimore.
2005- Graduate Faculty, Pathobiology Program, Johns Hopkins University School of Med, Baltimore
2006- Assoc Professor, Pathology, Johns Hopkins Univ School of Medicine, Baltimore.
2006 Assoc Professor, Oncology, Johns Hopkins University School of Medicine Baltimore.

RESEARCH ACTIVITIES: Peer-reviewed Scientific Publications

First and Last Author Papers

1. Maitra, A., Hirany, S. V. and Jialal, I. Comparison of two assays for measuring LDL cholesterol. *Clin Chem* 43:1040-7, 1997.
2. Maitra, A., Weinberg, A.G. Inclusions in lymphoblasts. *Ped Develop Pathol* 1:573, 1998.

3. Maitra, A., Yashima, K., Timmons, C. F., Rogers, B. B., Rathi, A., Shay, J. W., et al. The RNA component of telomerase as a marker of biologic potential and clinical outcome in childhood neuroblastic tumors. *Cancer* 85:741-9, 1999
4. Maitra, A., Amirkhan, R., Saboorian, M.H., Frawley, W., Ashfaq, R. Survival in small cell lung carcinoma is independent of Bcl-2 expression. *Hum Pathol* 30:712-7, 1999
5. Maitra, A., Wistuba, I.I., Virmani, A.K., Sakaguchi, M., Park, I., Stuckey, A., et al. Enrichment of epithelial cells for molecular studies. *Nature Med* 5:459-63, 1999
6. Maitra, A., Salahuddin, S., Timmons, C.F., Gazdar, A.F. Allelotyping nephrogenic rests: the putative precursor lesions of Wilms tumors. *Ped Develop Pathol.* 2:488-9, 1999.
7. Maitra, A., Wistuba, I.I., Gibbons, D.G., Gazdar, A.F., Albores-Saavedra, J. Allelic losses at chromosome 3p are seen in human papilloma virus 16 associated transitional cell carcinoma of the cervix. *Gynecol Oncol* 74:361-8, 1999
8. Maitra, A., Tavassoli, F.A., Albores-Saaverdra, J., Behrens, C., Wistuba, I.I., Weinberg, A.G., et al. Molecular abnormalities associated with secretory carcinomas of the breast. *Human Pathol* 30:1435-40, 1999.
9. Maitra A., Molberg, K.H., Albores-Saavedra, J., Lindberg, G. M. Loss of Dpc4 expression in colonic adenocarcinomas correlates with the presence of metastatic disease. *Am J Pathol* 157:1105-11; 2000
10. Maitra, A., Ward, P.J., Jamal, S., Kroft, S.H., Levinson, B.J., Fishleder, A., et al. Cytoplasmic inclusions in leukocytes: An unusual manifestation of cryoglobulinemia. *Am J Clin Pathol* 113:107-12, 2000
11. Maitra, A., Ashfaq, R., Saboorian, M.H., Gokaslan, S.T. The role of fine-needle aspiration biopsy in the primary diagnosis of mesenchymal lesions: a community hospital-based experience. *Cancer Cytopathol* 90:178-85; 2000
12. Maitra, A., Ramnani, D.M., Margraf, L., Gazdar, A.F. Synchronous Wilms tumor and fibrolamellar hepatocellular carcinoma : report of a case. *Ped Develop Pathol* 3:492-6, 2000
13. Maitra, A., Krueger, J.E., Tascilar, M., Klimstra, D.S., Hruban, R.H., Angeles-Angeles, A., and Albores-Saavedra, J. Carcinoid tumors of the extrahepatic bile ducts: a study of seven cases. *Am J Surg Pathol* 24:1501-10, 2000.
14. Maitra, A., Schneider, N.R., Weinberg, A.G, Patterson, K. Detection of t(11;22)(q24;q12) translocation and EWS-FLI-1 fusion transcript in a case of solid pseudopapillary tumor of the pancreas. *Pediatr Develop Pathol* 3:603-5; 2000
15. Maitra, A., Roberts, H., Weinberg, A.G, Geradts, J. Loss of p16(INK4a) expression correlates with decreased survival in pediatric osteosarcomas. *Int J Cancer (Predictive Oncology)* 95:34-8; 2001
16. Maitra, A., Wistuba, I.I., Washington, C., Virmani, A.K., Ashfaq, R., Milchgrub, S., et al. High-resolution chromosome 3p allelotyping of breast carcinomas and precursor lesions demonstrates frequent loss of heterozygosity and a discontinuous pattern of allele loss. *Am J Pathol* 159:119-30; 2001

17. Maitra, A., Wanzer, D., Weinberg, A.G, Ashfaq, R. Amplification of the HER-2/neu Oncogene is Uncommon in Pediatric Osteosarcomas. *Cancer* 92:677; 2001
18. Maitra, A., Roberts, H., Weinberg, A.G, Geraerts, J. Aberrant expression of tumor suppressor proteins in the Ewing family of tumors. *Archives Pathol Lab Med* 121:1207; 2001
19. Maitra, A., Rathi, A., Ashfaq, R., Sagalowsky, A. and Gazdar, A.F. Expression of the RNA component of human telomerase (hTR) in ThinPrep preparations from bladder washings. *Cancer Cytopathol* 93:73-9; 2001.
20. Maitra, A., Murakata, L., Albores-Saavedra, J. Immunoreactivity for hepatocyte paraffin 1 antibody in hepatoid adenocarcinomas of the gastrointestinal tract. *Am J Clin Pathol* 115:689-94; 2001.
21. Maitra, A., Hruban, R.H., Offerhaus, G.J., Tescilar, M., Albores-Saavedra, J. Small cell carcinoma of the gallbladder: a clinicopathologic, immunohistochemical, and molecular pathology study of 12 cases. *Am J Surg Pathol* 25:595-601; 2001.
22. Maitra, A., McKenna, R.W., Weinberg, A.G., Schneider, N.R., Kroft, S.H. Precursor B-cell lymphoblastic lymphoma. A study of nine cases lacking blood and bone marrow involvement and review of the literature. *Am J Clin Pathol* 115:868-75; 2001
23. Maitra, A., Timmons, C.F., Siddiqui, M., Saboorian, M.H. Fine-needle aspiration biopsy features in a case of giant cell fibroblastoma of the chest wall. *Arch Pathol Lab Med* 125:1091; 2001.
24. Maitra, A., Baskin, L., Lee, E.L. Malignancies arising in oncocytic schneiderian papillomas: a report of 2 cases and review of literature. *Archives Pathol Lab Med* 125:1365; 2001.
25. Maitra, A., Gazdar, A.F., Moore, T. O., Moore, A.Y. Loss of heterozygosity analysis of cutaneous melanoma and benign melanocytic nevi: laser capture microdissection demonstrates clonal genetic changes in acquired nevocellular nevi. *Hum Pathol* 33:191; 2002
26. Maitra, A., Domiati-Saad, R., Yost, N., Cunningham, G., Rogers, B.B., Bennett, M.J. Absence of the G1528C (E474Q) mutation in the alpha-subunit of the mitochondrial trifunctional protein in women with acute fatty liver of pregnancy. *Pediatr Res* 51:658; 2002
27. Maitra, A., Iacobuzio-Donahue, C., Sohn, T.A., Argani, P., Meyer, R., Yeo, C.J., et al. Immunohistochemical validation of a novel epithelial and a novel stromal marker of pancreatic ductal adenocarcinoma identified by global expression microarrays: Sea urchin fascin homolog and heat shock protein 47. *Am J Clin Pathol* 118:52-9; 2002.
28. Maitra, A., Ashfaq, R., Hruban, R.H., Wilentz, R.E. Cyclooxygenase 2 expression in pancreatic adenocarcinoma and pancreatic intraepithelial neoplasia: an immunohistochemical analysis with automated cellular imaging. *Am J Clin Pathol* 118:194-201; 2002
29. VanHeek, N.T., Meeker, A., Kern, S.E., Yeo, C.J., Lillemore, K.D., Cameron, J.L., Offerhaus, J.A., Hicks, J.L., Wilentz, R.E., Goggins, M.G., DeMarzo, A.M., Hruban, R.H., Maitra, A. Telomere shortening is nearly universal in Pancreatic Intraepithelial Neoplasia. *Am J Pathol* 161:1541-7; 2002.
30. Iacobuzio-Donahue, C.A.* Maitra, A., *van Heek, T., Sato, N., Olsen, M., Parker, A., et al. Exploration of global gene expression patterns in pancreatic adenocarcinoma using cDNA microarrays. *Am J Pathol* 162:1151-62; 2003 (*Equal contribution)

31. Hansel, D.E., Rahman, A., Hidalgo, M., Lillemoe, K., Schulick, R., Ku, J-L, Park, J-G, Miyazaki, K., Ashfaq, R., Wistuba, I.I., Geraerts, J., Argani, P., **Maitra, A.** Identification of Novel Cellular Targets in Biliary Tract Cancers using Global Gene Expression Technology *Am J Pathol* 163:217-29; 2003.
32. Hansel, D.E., Rahman, A., Hermans, J., de Krijger, R., Ashfaq, R., Yeo, C., Cameron, J., Hruban, R.H., **Maitra, A.** Liver metastases arising from well-differentiated pancreatic endocrine neoplasms demonstrate increased VEGF-C expression. *Mod Pathol* 16:652-9; 2003.
33. **Maitra, A.**, Adsay, V., Argani, P., Iacobuzio-Donahue, C., DeMarzo, A., Yeo, C.J., Cameron, J., Hruban, R.H. Multicomponent analysis of the pancreatic adenocarcinoma progression model using a Pancreatic Intraepithelial Neoplasia tissue microarray. *Mod Pathol* 16:902-12; 2003.
34. Berman, D.M.*., Karhadkar, S.*., **Maitra, A.***, Parker, A., Eshelman, J.R., Shimada, Y., Beachy, P. A. Widespread requirement for Hedgehog ligand stimulation in growth of digestive tract tumours. *Nature* 425:846-51; 2003 (* Equal contribution)
35. Hansel, D.E., Rahman, A., Wehner, S., Herzog, V., Yeo, C.J., **Maitra, A.** Increased expression and processing of the Alzheimer Amyloid Precursor Protein in pancreatic cancer may influence cellular proliferation. *Cancer Res* 63:7032-7; 2003
36. House, M.G., Wistuba, I.I., Argani, P., Guo, M., Schulick, R.D., Hruban, R.H., Herman, J.G., **Maitra, A.** Progression of gene hypermethylation in gallstone disease leading to gallbladder cancer. *Ann Surg Oncol* 10:882-9; 2003
37. **Maitra, A.**, Hansel, D.E., Argani, P., Ashfaq, R., Rahman, A., Naji, A., Deng, S., Geraerts, J., Hawthorne, L.A., House, M.G., Yeo, C.J. Global expression analysis of well-differentiated pancreatic endocrine neoplasms using oligonucleotide microarrays. *Clin Cancer Res* 9:5988-95; 2003
38. Hansel, D.E., Ashfaq, R., Rahman, A., Yeo, C.J., **Maitra, A.** MAGE1 is expressed by a subset of pancreatic endocrine neoplasms, and associated lymph node and liver metastases *Int J Gastrointestinal Cancer* 33:141-7; 2003
39. Hansel, D.E., Yeo, C.J., Cameron, J., Schulick, R.D., Montgomery, E.A., Wilentz, R. E., **Maitra, A.** Expression of neuropilin-1 in high-grade dysplasia, invasive cancer, and metastases of the human gastrointestinal tract. *Am J Surg Pathol* 28:347-56, 2004
40. **Maitra, A.**, Cohen, Y., Gillespie, S.E., Mambo, E., Fukushima, N., Hoque, M.O., Shah, N., Goggins, M., Califano, J., Sidransky, D., Chakaravarti, A. The Human MitoChip: a high-throughput sequencing microarray for mitochondrial mutation detection. *Genome Res* 14:812-9, 2004
41. Goldenberg, D., Rosenbaum, E., Argani, P., Wistuba, I.I., Thuluvath, P.J., Hidalgo, M., Califano, J., **Maitra, A.** The V599E BRAF mutation is uncommon in biliary tract cancers. *Mod Pathol* 17:1386-91, 2004
42. Koopmann, J., Thuluvath, P.J., Zahurak, M., Kristiansen, T.Z., Pandey, A., Schulick, R.D., Argani, P., Iacobelli, S., Goggins, M.G., **Maitra, A.** Mac-2 binding protein is a diagnostic marker for biliary tract carcinoma. *Cancer* 101:1609-15; 2004.
43. Hansel, D.E., Rahman, A., House, M.G., Ashfaq, R., Berg, K., Yeo, C.J., **Maitra, A.** Met proto-oncogene and insulin-like growth factor binding protein 3 overexpression correlates with metastatic ability in well-differentiated pancreatic endocrine neoplasms. *Clin Cancer Res* 10:6152-8, 2004

44. Hansel, D.E., Rahman, A., Wilentz, R.E., Shih, I., McMaster, M.T., Yeo, C.J., **Maitra, A.** HLA-G upregulation in pre-malignant and malignant lesions of the gastrointestinal tract *Int J Gastrointestinal Cancer* 35:15-23; 2005
45. Hansel, D.E., Ashfaq, A., Rahman, A., Wanzer, D., Yeo, C.J., Wilentz, R.E., **Maitra, A.** A subset of pancreatic adenocarcinomas demonstrates co-amplification of topoisomerase II α and Her-2/neu: Use of immunolabeling and multi-color FISH for potential patient screening and treatment. *Am J Clin Pathol* 123:28-35; 2005.
46. Hustinx, S.R., Hruban, R.H., Leoni, L.M., Iacobuzio-Donahue, C., Cameron, J.L., Yeo, C.J., Brown, P.N., Argani, P., Ashfaq, R., Fukushima, N., Goggins, M.G., Kern, S.E., **Maitra, A.** Homozygous deletion of the MTAP gene in invasive adenocarcinoma of the pancreas and in periampullary cancer: a potential new target for therapy. *Cancer Biol Ther* 4:83-6; 2005
47. Hustinx, S.R., Leoni, L.M., Yeo, C.J., Brown, P.N., Goggins, M.G., Kern, S.E., Hruban, R.H., **Maitra, A.** Concordant loss of MTAP and p16/CDKN2A expression in pancreatic intraepithelial neoplasia: evidence of homozygous deletion in a non-invasive precursor lesion. *Mod Pathol* 18:959-63; 2005
48. Nowak, N.J., Gaile, D., Conroy, J., McQuaid, D., Cowell, J., Carter, R., Goggins, M.G., Hruban, R.H., **Maitra, A.** Genome wide aberrations in pancreatic adenocarcinoma. *Cancer Genet Cytoogenet* 161:36-50; 2005
49. Cao, D., Wilentz, R.E., Abbruzzese, J.L., Ho, L., **Maitra, A.** Aberrant expression of maspin in idiopathic inflammatory bowel disease is associated with disease activity and neoplastic transformation. *Int J Gastrointest Cancer* 36:39-46, 2005
50. **Maitra, A.**, Arking, D.E., Shivapurkar, N., Ikeda, M., Statsny, V., Kassaeui, K., Sui, G., Cutler, D., Liu, Y., Brimble, S., Noaksson, K., Hyllner, J., Schulz, T.C., Zeng, X., Freed, W., Crook, J., Abraham, S., Colman, A., Sartipy, P., Matsui, S., Carpenter, M., Gazadar, A.F., Rao, M., Chakravarti, A. Genomic alterations in cultured human embryonic stem cells. *Nat Genet* 37:1099-103, 2005
51. Karikari, C., Mullendore, M.E., Eshleman, J.R., Argani, P., Leoni, L., Chattopadhyay, S., Hidalgo, M., **Maitra, A.** Homozygous deletions of methylthioadenosine phosphorylase in human biliary tract cancers. *Mol Cancer Therap* 4:1860-6; 2005
52. Zhou, S., Kassaeui, K., Cutler, D.J., Kennedy, G., Sidransky, D., **Maitra, A.***, Califano, J*. An oligonucleotide microarray for high-throughput sequencing of the mitochondrial genome. *J Mol Diagn* 8:476-82; 2006 (*corresponding authors)
53. Sui, G., Zhou, S., Cutler, D.J., Wang, J., Canto, M., Lee, E.E., Montgomery, E.A., Sidransky, D., Califano, J., **Maitra, A.** Mitochondrial DNA mutations in preneoplastic lesions of the gastrointestinal tract: a biomarker for the early detection of cancer. *Mol Cancer* 5:73; 2006
54. Kassaeui K., Habbe N., Mullendore M.E., Karikari C.A., **Maitra A.***, Feldmann G.*. Mitochondrial DNA mutations in pancreatic cancer. *Int J Gastrointest Cancer*;37:57-64. 2006 (Joint corresponding authors)
55. Karikari, C.A., Roy, I., Tryggestad, E., Feldmann, G., Pinilla, C., Reed, J., Armour, E.P>, Wong, J., Herman, J., Rakheja, D., **Maitra A.** Targeting the apoptotic machinery in pancreatic cancers using small-molecule antagonists of the X-linked inhibitor of apoptosis protein. *Mol Cancer Ther* 6:957-66; 2007

56. Feldmann, G., Dhara, S., Fendrich, V., Bedja, D., Beaty, R.M., Mullendore, M., Karikari, C.A., Alvarez, H., Iacobuzio-Donahue, C., Jimeno, A., Gabrielson, K.M., Matsui, W., **Maitra, A.** Blockade of Hedgehog signaling inhibits pancreatic cancer invasion and metastasis – a new paradigm for combination therapy in solid cancers. *Cancer Res* 67:2187-96; 2007
57. Bisht, S., Feldmann, G., Soni, S., Ravi, R., Karikari, C., Maitra, A., **Maitra, A.** Polymeric nanoparticle encapsulated curcumin (“nanocurcumin”): a novel strategy for human cancer therapy. *J Nanobiotechnol* 5:3; 2007 (Highly accessed article)
58. Tan, A.C., Fan, J.B., Karikari, C., Bibikova, M., Garcia, E.W., Zhou, L., Barker, D., Serre, D., Feldmann, G., Hruban, R.H., Klein, A.P., Goggins, M., Couch, F.J., Hudson, T.J., Winslow, R.L., **Maitra, A.***, Chakravarti, A.*. Allele-specific expression in the germline of patients with familial pancreatic cancer: An unbiased approach to cancer gene discovery. *Cancer Biol Ther.* 7(1):135-44, 2008 (Joint corresponding authors)
59. Feldmann, G., Habbe, N., Dhara, S., Bisht, S., Alvarez, H., Fendrich, V., Beaty, R., Mullendore, M., Karikari, C., Bardeesy, N., Oullette, M.M., Yu, W., **Maitra, A.** Hedgehog inhibition prolongs survival in a genetically engineered mouse model of pancreatic cancer. *Gut* 2008 DOI: 10.1136/gut.2007.148189 [Epub ahead of print].
60. Alvarez, H., Corvalan, A., Roa, J.C., Argani, P., Murillo, F., Edwards, J., Beaty, R., Feldmann, G., Hong, S-M., Mullendore, M., Roa, I., Ibañez, L., Pimente, F., Diaz, A., Riggins, G.J., **Maitra, A.** Serial Analysis of Gene Expression (SAGE) Identifies Connective Tissue Growth Factor (CTGF) Expression as a Prognostic Biomarker in Gallbladder Cancer. *Clin Cancer Res*, 14(9):2631-8, 2008
61. Zou, G.-M. and **Maitra, A.** Small-molecule inhibitor of the AP endonuclease 1/REF-1 E3330 inhibits pancreatic cancer cell growth and migration. *Mol Cancer Ther* 7(6), 2008.
62. Fendrich, V., Esni, F., Garay, M.V., Feldmann, G., Habbe, N., Jensen, J.N., Dor, Y., Stoffers, D., Jensen, J., Leach, S.D., **Maitra, A..** Hedgehog Signaling Is Required for Effective Regeneration of Exocrine Pancreas. *Gastroenterology*, 2008 Apr 16. [Epub ahead of print].
63. Alvarez, H., Leal Rojas, P., Yong, K.-T., Ding, H., Xu, G., Prasad, P.N., Wang, J., Canto, M., Eshleman, J.R., Montgomery, E.A., **Maitra, A.** Mesothelin is a specific biomarker of invasive cancer in the Barrett-associated adenocarcinoma progression model: Translational implications for diagnosis and therapy. *Nanomedicine: Nanotechnology, Biology, and Medicine* 2008 (In Press).
64. Zou, G.-M, **Maitra, A.** Small molecule inhibitor of the APE1/REF-1 E3330 inhibits pancreatic cancer cell growth and migration. *Mol Cancer Ther* 2008 (In Press).
65. Feldmann, G., Fendrich, V., McGovern, K., Bedja, D., Bisht, S., Alvarez, H., Koorstra, J.-B., Habbe, N., Karikari, C., Mullendore, M., Gabrielson, K., Sharma, R., Matsui, W., **Maitra, A.** An orally bioavailable small molecule inhibitor of Hedgehog signaling inhibits tumor initiation and metastasis in pancreatic cancer. *Mol Cancer Ther* 2008 (In Press).

Collaborative Papers

1. Yashima, K., **Maitra, A.**, Rogers, B. B., Timmons, C. F., Rathi, A., Pinar, H., et al. Expression of the RNA component of telomerase during human development and differentiation. *Cell Growth Diff*, 9:805-13, 1998.
2. Yashima, K., **Maitra, A.**, Timmons, C. F., Rogers, B. B., Pinar, H., Shay, J. W., et al. Expression of the RNA component of telomerase in Wilms tumor and nephrogenic rest recapitulates renal embryogenesis. *Hum Pathol*, 29:536-42, 1998.

3. Yashima, K., Milchgrub, S., Gollahon, L. S., Maitra, A., Saboorian, M. H., Shay, J. W., et al. Telomerase enzyme activity and RNA expression during the multistage pathogenesis of breast carcinoma. *Clin Cancer Res*, 4:229-34, 1998.
4. Lindberg, G., Maitra, A., Saboorian, M.H., Gokaslan, S.T., Albores Saavedra, J. Low grade fibromyxoid sarcoma: fine-needle aspiration cytology with histologic, cytogenetic, immunohistochemical, and ultrastructural correlation. *Cancer Cytopathol* 87:75-82, 1999
5. Euhus, D.M., Maitra, A., Wistuba, I.I., Alberts, A., Albores-Saavedra, J., Gazdar, A.F. Loss of heterozygosity at 3p in benign lesions preceding invasive breast cancer. *J Surg. Res.* 83:13-18, 1999
6. Shivapurkar, N., Sood. S., Wistuba, I.I., Virmani, A.K., Maitra, A., Milchgrub, S., Minna, J.D., Gazdar, A.F. Multiple regions of chromosome 4 demonstrating allelic losses in breast carcinomas. *Cancer Res* 59:3576-80, 1999
7. Park, I., Wistuba. I.I., Maitra, A., Milchgrub, S., Virmani, A.K., Gazdar, A.F. Multiple clonal abnormalities in the bronchial epithelium of patients with lung cancer. *J Natl Cancer Inst* 91:1863-8, 1999
8. Euhus, D.M., Maitra, A., Wistuba, I.I., Ashfaq, R., Alberts, A., Gibbons, D., Gazdar, et al. Use of archival fine needle aspirates for the allelotyping of tumors. *Cancer Cytopathol* 87:372-9, 1999.
9. Lin W.M., Ashfaq, R., Michalopoulos, E.A., Maitra, A., Gazdar, A.F., Muller, C.Y. Molecular Papanicolaou tests in the 21st century: Molecular analyses with fluid-based Papanicolaou technology. *Am J Obstet Gynecol* 183:39-45; 2000.
10. Behrens, C., Travis, L.B., Wistuba, I.I., Davis, S., Maitra, A., et al. Molecular changes in second primary lung and breast cancers after therapy for Hodgkin's disease. *Cancer Epidemiol Biomarkers Preven* 9:1027-35; 2000.
11. Wistuba, I.I., Berry, J., Behrens, C., Maitra, A., Shivapurkar, N., Milchgrub, S., Mackay, B., Minna, J.D., Gazdar, A.F. Molecular changes in the bronchial epithelium of patients with small cell lung cancer. *Clin Cancer Res* 6:2604-10; 2000.
12. Krueger, J.E., Maitra, A., Albores-Saavedra, J. Inherited medullary microcarcinoma of the thyroid: a study of 11 cases. *Am J Surg Pathol* 24:853-8; 2000
13. Virmani, A.K., Rathi, A., Zochbauer-Muller, S, Sacchi, N., Fukuyama, Y., Bryant, D., Maitra, A., Heda, S., Fong, K.M., Thunnissen, F, Minna, J.D., Gazdar, A.F. Promoter methylation and silencing of the retinoic acid receptor-beta gene in lung carcinomas. *J Natl Cancer Inst* 92:1303-7; 2000
14. Shivapurkar, N., Maitra, A., Milchgrub, S., Wistuba, I.I., Gazdar, A.F. Deletions of chromosome 4 occur early during the pathogenesis of colorectal carcinoma. *Hum Pathol* 32:169-77, 2001.
15. Zöchbauer-Müller, S., Fong, K.M., Maitra, A., et al. 5' CpG island methylation of the *FHIT* gene is correlated with loss of gene expression in lung and breast cancer. *Cancer Res (Advances in Brief)* 61:3581-5; 2001.
16. Wistuba, I.I., Tang, M., Maitra, A., et al. Genome-wide allelotyping analysis reveals multiple sites of allelic loss in gallbladder carcinoma. *Cancer Res* 61:3795-800; 2001
17. Hoang, M, Maitra, A., Gazdar, A.F., Albores-Saavedra, J. Primary mammary small-cell carcinoma: a molecular analysis of 2 cases. *Hum Pathol* 32:753-7; 2001.

18. Xu, X.L., Lu, W.C., Du, F., Davis, A., Peyton, M., Tomizawa, Y., **Maitra, A.** et al. Inactivation of human SRBC, located within the 11p15.5-p15.4 tumor suppressor region, in breast and lung cancers. *Cancer Res* 61:7943-9; 2001.
19. Iacobuzio-Donahue, C.A., **Maitra, A.**, Sheng-Ong, G.L., van Heek, T., Ashfaq, R., Meyer, R., et al. Discovery of novel tumor markers of pancreatic cancer using global gene expression technology. *Am J Pathol* 160:1239-49; 2002
20. Wistuba, I.I., Ashfaq, R., **Maitra, A.**, Pimentel, F., Troncoso, P., Alvarez, H. Fragile histidine triad gene abnormalities in the pathogenesis of gallbladder carcinoma. *Am J Pathol* 160:2073-9; 2002.
21. Wistuba, I.I., **Maitra, A.**, Carrasco, R., Tang, M., Troncoso, P., Minna, J.D., Gazdar, A.F. High resolution chromosome 3p, 8p, 9q and 22q allelotyping analysis in the pathogenesis of gallbladder carcinoma. *Br J Cancer* 87:432-40; 2002.
22. Harada, K., Toyooka, S., **Maitra, A.**, Mastrangelo, D., Timmons, C. F., Tomlinson, G. E., Gazdar, A. F. Aberrant promoter methylation and silencing of the RASSF1A gene in pediatric tumors and cell lines. *Oncogene* 21:4345-9; 2002.
23. Toyooka, K.O., Toyooka, S., **Maitra, A.**, Feng, Q., Kiviat, N.C., Smith, A., et al. Establishment and validation of real-time polymerase chain reaction method for CDH1 promoter methylation. *Am J Pathol* 161:629-34; 2002.
24. Torbenson, M.S., Wang J., Choti M., Ashfaq R., **Maitra A.**, Wilentz R.E, et al. Hepatocellular carcinomas show abnormal expression of fibronectin protein. *Mod Pathol* 15:826-30; 2002.
25. Torbenson, M.S., Marinopoulos, S., Dang, D.T., Chota, M., Ashfaq, R., **Maitra, A.**, et al. Smad4 overexpression in hepatocellular carcinoma is strongly associated with transforming growth factor beta II receptor immunolabeling. *Hum Pathol* 33:871-6; 2002
26. Harada, K., Toyooka, S., Shivapurkar. N., **Maitra, A.**, Reddy, J., Matta, H., et al. Dereulation of caspase 8 and 10 expression in pediatric tumors and cell lines. *Cancer Res* 62:5897-901; 2002.
27. Hempen, P.M., Zhang, L., Bansal, R.K., Iacobuzio-Donahue, C., Murphy, K., **Maitra, A.**, et al. Evidence of selection for clones having genetic inactivation of the activin A type II receptor (ACVR2) gene in gastrointestinal cancer. *Cancer Res* 63:994-9; 2003
28. Sato, N., **Maitra, A.**, van Heek, N.T., Fukushima, N., Iacobuzio-Donahue, C., Rosty, C. et al. Frequent hypomethylation of multiple genes overexpressed in pancreatic ductal adenocarcinoma. *Cancer Res* 63:4158-66; 2003
29. Ye, D., **Maitra, A.**, Timmons, C.F., Leavey, P., Ashfaq, R., Ilaria, Jr., R.L. The epidermal growth factor receptor HER2 is not a major therapeutic target in Ewing's sarcoma. *J Ped Hem Oncol* 25:459-66; 2003
30. Sato, N., Fukushima, N., **Maitra, A.**, Matsubayashi, H., Yeo. C., Cameron, J., Hruban, R.H., Goggins, M. Discovery of novel targets for aberrant methylation in pancreatic carcinoma using high-throughput microarrays. *Cancer Res* 63:3735-42; 2003.
31. Sahin, F., **Maitra, A.**, Argani. P., Sato, N., Maehara, N., Montgomery, E., Goggins, M., Hruban, R., Su, G.H. Loss of Stk11/Lkb1 expression in pancreatic and biliary neoplasms. *Mod Pathol* 16:686-91; 2003.

32. Rathi, A., Virmani, A.K., Harada, K., Timmons, C.F., Mijima, K., Hay, R., Mastranegro, D., **Maitra, A.**, Tomlinson, G.E., Gazdar, A.F. Aberrant methylation of the HIC1 promoter is a frequent event in specific pediatric neoplasms. *Clin Cancer Res* 9:3674-8; 2003
33. Miyamoto, Y., **Maitra, A.**, Zechner, U., Argani, P., Iacobuzio-Donahue, C., Sriuranpong, V. et al. Notch mediates TGF alpha-induced changes in epithelial differentiation during pancreatic tumorigenesis. *Cancer Cell* 3:565-76; 2003
34. McCarthy DM, **Maitra A**, Argani P, Rader AE, Faigel DO, Van Heek NT, Hruban RH, Wilentz RE. Novel markers of pancreatic adenocarcinoma in fine-needle aspiration: mesothelin and prostate stem cell antigen labeling increases accuracy in cytologically borderline cases. *Appl Immunohistochem Mol Morphol*. 11:238-43; 2003
35. Torbenson, M. S., Wang, J., Abraham, S., **Maitra, A.**, Boitnott, J.B. Bile ducts and ductules are positive for CD56 (N-CAM) in most cases of extrahepatic biliary atresia. *Am J Surg Pathol* 27:1454-7; 2003.
36. Rahman, A., **Maitra, A.**, Yeo, C.J., Cameron, J.L., Hruban, R.H., Ashfaq, R., Hansel, D.E. Loss of p27 nuclear expression in a prognostically favorable subset of well-differentiated pancreatic endocrine neoplasms. *Am J Clin Pathol* 120:685-90; 2003
37. House, M.G., Guo, M.Z., Herman, J. G., Schulick, R.D., Cameron, J.L., Hruban, R.H., **Maitra, A.**, Yeo, C.J. Aberrant hypermethylation of tumor suppressor genes in pancreatic endocrine neoplasms. *Ann Surg* 238:423-31; 2003
38. House, M.G., Guo, M.Z., Hooker, C.M., Herman, J.G., Schulick, R.D., Cameron, J.L., Hruban, R.H., **Maitra, A.**, Yeo, C.J. Prognostic value of hMLH1 methylation and microsatellite instability in pancreatic endocrine neoplasms. *Surgery* 134:902-8; 2003
39. Yeh, C-N., **Maitra, A.**, Lee, K-F., Jan, Y-Y., Chen, M-F. Thioacetamide-induced intestinal-type cholangiocarcinoma in rat: an animal model recapitulating the multi-stage progression of human cholangiocarcinoma. *Carcinogenesis* 25:631-6, 2004.
40. Hingorani, S.R., Petricoin, E.F., **Maitra, A.**, King, C., Jacobetz, M.A., Yoshiya, K., Crawford, H.C., Putt, M.E., Jacks, T., Wright, C.V., Hruban, R.H., Lowy, A.M., Tuveson, D.A. Preinvasive and invasive ductal pancreatic cancer and its early detection in the mouse. *Cancer Cell* 4:437-50; 2003
41. Iacobuzio-Donahue, C., Ashfaq, R., **Maitra, A.**, Adsay, V., Shen-Ong, G.L., Berg, K., Hollingsworth, M., Cameron J., Yeo, C.J., Kern, S.E., Goggins, M.G., Hruban, R.H. Highly expressed genes in pancreatic ductal adenocarcinomas: a comprehensive characterization and comparison of the transcription profiles obtained from three major technologies. *Cancer Res* 63:8614-22; 2003
42. Koopmann, J., Fedarko, N., Jain, A., **Maitra, A.**, Iacobuzio-Donahue, C.A., Yeo, C.J., Hruban, R.H., Goggins, M.G. Evaluation of osteopontin as a biomarker for pancreatic adenocarcinoma. *Cancer Epidemiol Biomarkers Prev* 13:487-91; 2004.
43. Sato, N., Fukushima, N., **Maitra, A.**, Iacobuzio-Donahue, C., Matsubayashi, H., Yeo. C., Cameron, J., Hruban, R.H., Goggins, M. Gene expression profiling identifies genes associated with invasive intraductal papillary mucinous neoplasms of the pancreas. *Am J Pathol* 164:903-14; 2004.
44. Swierczynski S.L., **Maitra, A.**, Abraham, S.C., Iacobuzio-Donahue, C.A., Ashfaq, R., Cameron, J.L., Schulick, R.D., Yeo, C.J., Rahman, A., Hinkle, D.A., Hruban, R.H., Argani, P. Analysis of novel tumor markers in pancreatic and biliary carcinomas using tissue microarrays. *Hum Pathol* 35:357-66; 2004

45. Parker, A.R., Leonard, C.P., Hua, L., Francis, R., Dhara, S., **Maitra, A.**, Eshleman, J.R. A subgroup of microsatellite stable colorectal cancers has elevated mutation rates and different responses to alkylating and oxidizing agents. *Br J Cancer* 90:1666-71; 2004
46. van Heek, N.T., **Maitra, A.**, Koopmann, J., Fedarko, N., Jain, A., Rahman, A., Iacobuzio-Donahue, C.A., Adsay, V., Ashfaq, R., Yeo, C.J., Cameron, J., Offerhaus, J., Hruban, R.H., Berg, K., Goggins, M.G. Gene expression profiling identifies markers of ampullary adenocarcinoma. *Cancer Biol Ther* 3:651-6; 2004
47. Kristiansen, T.Z., Bunkerborg, J., Gronborg, M., Molina, H., Thuluvath, P.J., Argani, P., Goggins, M.G., **Maitra, A.**, Pandey, A. A proteomic analysis of human bile. *Mol Cell Proteomics* 3:715-28; 2004
48. Hruban, R.H., Takaori, K., Klimstra, D., Adsay, N.V., Albores-Saavdera, J., Biankin, A., Biankin, S., Compton, C., Fukushima, N., Furukawa, T., Goggins, M., Kato, Y., Kloppel, G., Longnecker, D., Luttges, J., **Maitra, A.**, Offerhaus, J., Shimuzu, M., Yonezawa, S. An illustrated consensus on the classification of Pancreatic Intraepithelial Neoplasia and intraductal papillary mucinous neoplasms. *Am J Surg Pathol* 28:977-87, 2004
49. Gronborg, M., Bunkerborg, J., Kristiansen, T.Z., Jensen, O.N., Yeo, C.J., Hruban, R.H., **Maitra, A.**, Goggins, M.G., Pandey, A. Comprehensive proteomic analysis of human pancreatic juice. *J Proteome Res* 3:1042-55, 2004
50. Amador, M., Oppenheimer, D., Perea, S., **Maitra, A.**, Cusati, G., Iacobuzio-Donahue, C., Baker, S., Ashfaq, R., Takimoto, C., Forastiere, A., Hidalgo, M. An epidermal growth factor receptor intron 1 polymorphism mediates response to epidermal growth factor receptor inhibitors. *Cancer Res* 64:9139-43; 2004
51. Karhadkar, S., Bova, G.S., Abdallah, N., Dhara, S., Gardner, D., **Maitra, A.**, Isaacs, J.T., Berman, D.M., Beachy, P.A. Hedgehog signaling in prostate regeneration, neoplasia, and metastasis. *Nature* 431:707-12, 2004
52. Cao, D., Hustinx, S.R., Sui, G., Bala, P., Sato, N., Martin, S., **Maitra, A.**, Murphy, K.M., Cameron, J.L., Yeo, C.J., Kern, S.E., Goggins, M.G., Pandey, A., Hruban, R.H. Identification of novel highly expressed genes in pancreatic ductal adenocarcinomas through a bioinformatics analysis of expressed sequence tags. *Cancer Biol Therapy* 3:1081-9; 2004
53. Hustinx, S.R., Cao, D., **Maitra, A.**, Sato, N., Martin, S.T., Sudhir, D., Iacobuzio-Donahue, C., Cameron, J.L., Yeo, C.J., Kern, S.E., Goggins, M.G., Mollenhauer, J., Pandey, A., Hruban, R.H. Differentially expressed genes in pancreatic ductal adenocarcinomas identified through serial analysis of gene expression. *Cancer Biol Ther* 3:1254-61; 2004
54. Henke, R.T., Haddad, B.R., Kim, S.E., Rone, J.D., Mani, A., Jessup, J.M., Wellstein, A., **Maitra, A.**, Riegel, A.T. Overexpression of the nuclear receptor coactivator AIB1 (SRC-3) during progression of pancreatic adenocarcinoma. *Clin Cancer Res* 10:6134-42, 2004
55. Hansel, D.E., **Maitra, A.**, Lin, J., Goggins, M.G., Argani, P., Yeo, C.J., Piantadosi, S., Leach, S.D., Biankin, A.V. Expression of caudal-type homeodomain transcription factors CDX 1/2 and outcome in carcinomas of the ampulla of Vater. *J Clin Oncol* 23:1811-8; 2005
56. Jimeno, A., Rubio, B., Amador, M.L., Oppenheimer, D., Bouraoud, N., Kulesza, P., Sebastini, V., **Maitra, A.**, Hidalgo M. Epidermal growth factor receptor dynamics influences response to epidermal growth factor receptor targeted agents. *Cancer Res* 65:3003-10; 2005

57. Bashyam, M. D., Bair, R., Kim, Y.H., Wang, P., Hernandez-Boussard, T., Karikari, C.A., Tibshirani, R., **Maitra, A.**, Pollack, J.R. Array-based comparative genomic hybridization identifies localized DNA amplifications and homozygous deletions in pancreatic cancer. *Neoplasia* 7:556-62; 2005
58. Hansel, D.E., Dhara, S., Huang, R.C., Ashfaq, R., Diesel, M., Shimada, Y., Bernstein, H., Harmon, J., Brock, M., Forastiere, A., Washington, M.K., **Maitra, A.**, Montgomery, E. CDC2/CDK1 expression in esophageal adenocarcinoma and precursor lesions serves as a diagnostic and cancer progression marker and potential novel drug target. *Am J Surg Pathol* 29:390-9; 2005
59. Cao, D., **Maitra, A.**, Saavedra, J.A., Klimstra, D., Adsay, N.V., Hruban, R.H. Expression of novel markers of pancreatic ductal adenocarcinoma in pancreatic non-ductal neoplasms: additional evidence of different genetic pathways. *Mod Pathol* 18:752-61; 2005
60. Prasad, N., Biankin, A.V., Fukushima, N., **Maitra, A.**, Dhara, S., Elkahloun, A.G., Hruban, R.H., Goggins, M.G., Leach, S.D. Gene expression profiles in pancreatic intraepithelial neoplasia reflect the effects of Hedgehog signaling on pancreatic ductal epithelial cells. *Cancer Res* 65:1619-26; 2005
61. Cunningham, S.C., Kamnagar, F., Kim, M., Hammoud, S., Haque, R., **Maitra, A.**, Montgomery, E.A., Heitmiller, R., Choti, M., Lillemoe, K., Cameron, J.L., Yeo, C.J., Schulick, R.D. Survival after gastric adenocarcinoma resection: eighteen-year experience at a single institution. *J Gastrointest Surg* 9:718-25; 2005
62. Powell, E.L., Leoni, L.M., Canto, M.I., Forastiere, A.A., Iacobuzio-Donahue, C.A., Wang, J.S., **Maitra, A.**, Montgomery, E. Concordant Loss of MTAP and p16/CDKN2A Expression in Gastroesophageal Carcinogenesis: Evidence of Homozygous Deletion in Esophageal Noninvasive Precursor Lesions and Therapeutic Implications. *Am J Surg Pathol.* 29:1497-1504, 2005
63. Hustinx, S.R., Fukushima, N., Zahurak, M.L., Riall, T.S., **Maitra, A.**, Brosens, L., Cameron, J.L., Yeo, C.J., Offerhaus, G.J., Hruban, R.H., Goggins, M. Expression and Prognostic Significance of 14-3-3sigma and ERM Family Protein Expression in Periampullary Neoplasms. *Cancer Biol Ther.* 4:596-601, 2005
64. Chen, Y.C., Davidson, B., Cheng, C.C., **Maitra, A.**, Giuntoli, R.L. 2nd, Hruban, R.H., Wang, T.L., Shih, I.M. Identification and characterization of membralin, a novel tumor associated gene, in ovarian carcinoma. *Biochim Biophys Acta* 1730:96-102; 2005
65. Duxbury, M.S., Matros, E., Clancy, T., Bailey, G., Doff, M., Zinder, M.J., Ashley, S.W., **Maitra, A.**, Redston, M., Whang, E.E. CEACAM6 is a novel biomarker in pancreatic adenocarcinoma and PanIN lesions. *Ann Surg* 241:491-6; 2005
66. Jakupciak, J.P., Wang, W., Markowitz, M.E., Ally, D., Coble, M., Srivastava, S., **Maitra, A.**, Barker, P.E., Sidransky, D., O'Connell, C. D. Mitochondrial DNA as a cancer biomarker. *J Mol Diagn* 7:258-67; 2005
67. Gronborg, M., Kristiansen, T.Z., Iwahori, A., Chang, R., Reddy, R., Sato, N., Molina, H., Jensen, O.N., Hruban, R.H., Goggins, M.G., **Maitra, A.**, Pandey, A. Biomarker discovery from pancreatic cancer secretome using a differential proteomic approach. *Mol Cell Proteomics* 5:157-71; 2006
68. Martin, S.T., Sato, N., Dhara, S., Chang, R., Hustinx, S., Abe, T., **Maitra, A.**, Goggins, M.G. Aberrant methylation of the human hedgehog interacting protein (HHIP) gene in pancreatic neoplasms. *Cancer Biol Ther* 4:728-33; 2005

69. Plaia, T.W., Josephson, R., Liu, Y., Zeng, X., Ording, C., Toumadje, A., Brimble, S.N., Sherrer, E.S., Uhl, E.W., Freed, W.J., Schultz, T.C., **Maitra, A.**, Rao, M.S., Auerbach, J.M. Characterization of a New NIH Registered Variant Human Embryonic Stem Cell Line BG01V: A Tool for Human Embryonic Stem Cell Research. *Stem Cells* 24:531-46; 2006
70. House, M.G., Cameron, J.L., Lillemoe, K.D., Sculick, R.D., Choti, M.A., Hansel, D.E., Hruban, R.H., **Maitra, A.**, Yeo, C.J. Differences in Survival for Patients With Resectable Versus Unresectable Metastases From Pancreatic Islet Cell Cancer. *J Gastrointest Surg* 10:138-45; 2006
71. Tassi, E., Henke, R.T., Bowden, E.T., Swift, M.R., Kodack, D.P., **Maitra, A.**, Wellstein, A. Expression of a fibroblast growth factor-binding protein during the development of adenocarcinoma of the pancreas and colon. *Cancer Res* 66:1191-8; 2006
72. Hruban, R.H., Adsay, N.V., Albores-Saavedra, J., Anver, M.R., Biankin, A.V., Boivin, G.P., Furth, E.E., Furukawa, T., Klein, A., Klimstra, D.S., Kloppel, G., Lauwers, G.Y., Longnecker, D.S., Luttges, J., **Maitra, A.**, Offerhaus, G.J., Perez-Gallego, L., Redston, M., Tuveson, D.A. Pathology of genetically engineered mouse models of pancreatic exocrine cancer: consensus report and recommendations. *Cancer Res* 66:95-106; 2006
73. Montgomery, E., Mamelak, A., Gibson, M., **Maitra, A.**, Sheikh, S., Amr, S.S., Yang, S., Brock, M., Forastiere, A., Zhang, S., Murphy, K.M., Berg, K.D. Overexpression of claudin proteins in esophageal adenocarcinoma and its precursor lesions. *Appl Immunohistochem Mol Morphol* 14:24-30; 2006
74. Cunningham, S.C., Kamnagar, F., Kim, M.P., Hammoud, S., Haque, R., Iacobuzio-Donahue, C., Ashfaq, R., Kern, S.E., **Maitra, A.**, Yeo, C.J., Schulick, R.D., Montgomery, E. Claudin-4, mitogen-activated protein kinase kinase 4, and stratifin are markers of gastric adenocarcinoma precursor lesions. *Cancer Epidemiol Biomarkers Prev* 15:281-7; 2006
75. Sui, G., Bonde, P., Dhara, S., Broor, A., Wang, J., Marti, G., Ferguson, M., Duncan, M., Montgomery, E., **Maitra, A.**, Harmon, J. Epidermal growth factor receptor and hedgehog signaling pathways are active in esophageal cancer cells from rat reflux model. *J Surg Res* 134:1-9; 2006.
76. Rakheja, D., **Maitra, A.**, Kapur, P., Weinberg, A.G. Extrahepatic biliary atresia demonstrates abnormal persistence of HES1 protein in neonatal biliary epithelium: an immunohistochemical study. *Pediatr Dev Pathol* 9:98-102; 2006.
77. Moff, S.L., Clark, D.P., **Maitra, A.**, Pandey, A., Thuluvath, P.J. Utility of bile duct brushings for the early detection of cholangiocarcinoma in patients with primary sclerosing cholangitis. *J Clin Gastroenterology* 40:336-41; 2006.
78. Hidalgo, M., Amador, M.L., Jimeno, A., Mezzadra, H., Patel, P., Chan, A., Nielsen, M.E., **Maitra, A.**, Altiock, S. Assessment of Gefitinib and CI-1040-mediated changes in epidermal growth factor receptor signaling in HuCCT-1 human cholangiocarcinoma by serial fine needle aspiration. *Mol Cancer Ther* 5:1895-903; 2006.
79. Rubio-Viqueira, B., Jimeno, A., Cusatis, G., Zhang, X., Iacobuzio-Donahue, C., Karikari, C., Shi, C., Danenberg, K., Danenberg, P.V., Kuramochi, H., Tanaka, K., Singh, S., Salimi-Moosavi, H., Bouraoud, N., Amador, M.L., Altiock, S., Kulesza, P., Yeo, C.J., Messrsmit, W., Eshleman, J.R., Hruban, R.H., **Maitra, A.**, Hidalgo, M. An *in vivo* platform for translational drug development in pancreatic cancer. *Clin Cancer Res* 12:4652-61; 2006

80. Hansel D.E., Meeker A.K., Hicks J., De Marzo A., Lillemoe K.D., Schulick R., Hruban R.H., Maitra A., Argani P. Telomere length variation in biliary tract metaplasia, dysplasia, and carcinoma. *Mod Pathol* 19:772-9; 2006
81. Tsuji, K., Yeng, M., Jiang, P., Maitra, A., Kaushal, S., Yamauchi, K., Katz, M., Moossa, A. R., Hoffman, R.M., Bouvet, M. Common bile duct injection as a novel method for establishing red fluorescent protein (RFP)-expressing human pancreatic cancer in nude mice. *JOP* 7:193-9; 2006
82. Jiang, P., Yamauchi, K., Yang, M., Tsuji, K., Xu, M., Maitra, A., Bouvet, M., Hoffman, R.M. Tumor cells genetically labeled with GFP in the nucleus and RFP in the cytoplasm for imaging cellular dynamics. *Cell Cycle* 5:1198-201; 2006
83. Cao, D., Antonescu, C., Wong, G., Winter, J., Maitra, A., Adsay, V., Klimstra, D.S., Hruban, R.H. Positive immunohistochemical staining of KIT in solid-pseudopapillary neoplasms of the pancreas is not associated with KIT/PDGFR α mutations. *Mod Pathol* 19:1157-63; 2006
84. Bibikova, M., Chudin, E., Wu, B., Zhou, L., Wickham, G.E., Liu, Y., Shin, S., Plaia, T., Auerbach, J., Arking, D.E., Gonzalez, R., Crook, J., Davidson, B., Schulz, T., Robins, A., Khanna, A., Sartipy, P., Hyllner, J., Vanguri, P., Savant-Bhonsale, S., Smith, A.K., Chakravarti, A., Maitra, A., Rao, M., Barker, D.L., Loring, J.F., Fan, J.B. Human embryonic stem cells have a unique epigenetic signature. *Genome Res* 16:1075-83; 2006
85. Calhoun, E., Hucl, T., Gallmeier, E., West, K.M., Arking, D.E., Maitra, A., Jacobuzio-Donahue, C., Chakravarti, A., Hruban, R.H., Kern, S.E. Identifying allelic loss and homozygous deletions in pancreatic cancer without matched normals using high-density single nucleotide polymorphism arrays. *Cancer Res* 66:7920-8; 2006
86. Josephson, R., Sykes, G., Liu, Y., Ording, C., Xu, W., Zeng, X., Shin, S., Loring, J., Maitra, A., Rao, M.S., Auerbach, J. A molecular scheme for improved characterization of human embryonic stem cell lines. *BMC Biol* 4:28; 2006.
87. Brune, K., Abe, T., Canto, M., O'Malley, L., Klein A., Maitra, A., Adsay, N.V., Fishman, E., Cameron, J.L., Yeo, C.J., Kern, S.E., Goggins, M.G., Hruban, R.H. Multifocal neoplastic precursor lesions associated with lobular atrophy of the pancreas in patients having a strong family history of pancreatic cancer. *Am J Surg Pathol* 30:1067-76; 2006
88. Amoh, Y., Nagakura, C., Maitra, A., Moossa, A.R., Katsuoka, K., Hoffman, R., Bouvet, M. Dual-color imaging of nascent angiogenesis and its inhibition in liver metastases of pancreatic cancer. *Anticancer Res* 26:3237-42; 2006
89. Cunningham, S.C., Kamnagar, F., Kim, M.P., Hammoud, S., Haque, R., Jacobuzio-Donahue, C., Ashfaq, R., Kern, R., Maitra, A., Heitmiller, R., Choti, M., Lillemoe, K.D., Cameron, J.L., Yeo, C.J., Montgomery, E., Schulick, R.D. MKK4 status predicts survival after resection of gastric adenocarcinoma. *Arch Surg* 141:1095-9; 2006
90. Jimeno, A., Amador, M.L., Kulesza, P., Wang, X., Rubio-Viquera, B., Zhang, X., Chan, A., Wheelhouse, J., Kuramochi, H., Tanaka, K., Danenberg, K., Messersmith, W.A., Almuete, V., Hruban, R.H., Maitra, A., Yeo, C.J., Hidalgo, M. Assessment of celecoxib pharmacodynamics in pancreatic cancer. *Mol Cancer Ther* 5:3240-7; 2006
91. Lam-Himlin D.M., Daniels J.A., Gayyed M.F., Dong J., Maitra A., Pan D., Montgomery E.A., Anders R.A. The hippo pathway in human upper gastrointestinal dysplasia and carcinoma: a novel oncogenic pathway. *Int J Gastrointest Cancer*. 37:103-9, 2006.

92. Rubio-Viqueira, B., Mezzadra, H., Nielsen, M.E., Jimeno, A., Zhang, X., Iacobuzio-Donahue, C., **Maitra, A.**, Hidalgo, M., Altio, S. Optimizing the development of targeted agents in pancreatic cancer: tumor fine-needle aspiration biopsy as a platform for novel prospective *ex vivo* drug sensitivity assays. *Mol Cancer Ther* 6:515-23; 2007
93. Bonde, P., Sui, G., Dhara, S., Broor, A., Kim, I.F., Wiley, J.E., Wang, J., Marti, G., Ferguson, M., Duncan, M., Jaffee, E.M., Montgomery, E.A., **Maitra, A.**, Harmon, J.W. Cytogenetic characterization and gene expression profiling in the rat reflux induced esophageal tumor model. *J Thorac Cardiovasc Surg* 133:763-9; 2007
94. Jimeno, A., Rubio-Viqueira, B., Amador, M.L., Grunwald, V., **Maitra, A.**, Iacobuzio-Donahue, C., Hidalgo, M. Dual mitogen-activated protein kinase and epidermal growth factor receptor inhibition in biliary and pancreatic cancer. *Mol Cancer Ther* 6:1079-88; 2007
95. Cao, D., Zhang, Q., Wu, L.S., Salaria, S., Winter, J., Hruban, R.H., Goggins, M., Abbruzzese, J.L., **Maitra, A.**, Ho, L. Prognostic significance of maspin in pancreatic ductal adenocarcinoma: tissue microarray analysis of 223 surgically resected cases. *Mod Pathol* 20:570-8; 2007
96. Salaria, S., Illei, P., Sharma, R., Walter, K.M., Klein, A.P., Eshleman, J.R., **Maitra, A.**, Schulick, R., Winter, J., Ouellette, M., Goggins, M., Hruban, R.H. Palladin is overexpressed in the non-neoplastic stroma of infiltrating ductal adenocarcinomas of the pancreas, but is only rarely overexpressed in neoplastic cells. *Cancer Bio Ther* 6:324-8; 2007
97. Zhou, S., Kachhap, S., Sun, W., Wu, G., Chuang, A., Poeta, L., Grumbine, L., Mithani, S.K., Chatterjee, A., Koch, W., Westra, W.H., **Maitra, A.**, Glazer, C., Carducci, M., Sidransky, D., McFate, T., Verma, A., Califano, J. Frequency and phenotypic implications of mitochondrial DNA mutations in human squamous cell cancers of the head and neck. *Proc Natl Acad Sci* 104; 7540-5; 2007
98. Yong, K.T., Qian, J., Roy, I., Lee, H.H., Bergey, E.J., Tramposch, K.M., He, S., Swihart, M., **Maitra, A.**, Prasad, P.N. Quantum rod bio-conjugates as targeted probes for confocal and two-photon fluorescence imaging of cancer cells. *Nano Lett* 7:761-5; 2007
99. Chang, T.C., Wentzel, E.A., Kent, O.A., Ramachandran, K., Mullendore, M., Lee, K.H., Feldmann, G., Yamakuchi, M., Ferlito, M., Lowenstein, C.J., Arking, D.E., Beer, M.A., **Maitra, A.**, Mendell, J.T. Transactivation of miR-34a by p53 broadly influences gene expression and promotes apoptosis. *Mol Cell* 26:745-52; 2007
100. Dong, J., Feldmann, G., Huang, J., Wu, S., Zhang, N., Comerford, S.A., Gayyed, M.F., Anders, R.A., **Maitra, A.**, Pan, D. Elucidation of a universal size-control mechanism in Drosophila and mammals. *Cell* 130:1120-33; 2007
101. Wu, F., Dassopoulos, T., Cope, L., **Maitra, A.**, Brant, S.R., Harris, M.L., Bayless, T., Parmiagani, G., Chakravarti, S. Genome wide gene expression differences in Crohn's and ulcerative colitis from endoscopic pinch biopsies: insights into distinctive pathogenesis. *Inflamm Bowel Dis*; 13(7):807-21; 2007
102. Foss, C.A., Fox, J.J., Feldman, G., **Maitra, A.**, Iacobuzio-Donahue, C., Kern, S.E., Hruban, R.H., Pomper, M.G. Radiolabeled anti-claudin 4 and anti-prostate stem cell antigen: initial imaging in experimental models of pancreatic cancer. *Mol Imaging* 6:131-9; 2007
103. Mithani, S.K., Smith, I.M., Zhou, S., Gray, A., Koch, W.M., **Maitra, A.**, Califano, J.A. Mitochondrial resequencing arrays detect tumor-specific mutations in salivary rinses of patients with head and neck cancer. *Clin Cancer Res*. 13:7335-40, 2007

104. Daniels, J.A., Lederman, H.M., **Maitra, A.**, Montgomery, E.A. Gastrointestinal tract pathology in patients with common variable immunodeficiency (CVID): a clinicopathologic study and review. *Am J Surg Pathol.* 31:1800-12, 2007
105. Fendrich, V., Waldmann, J., Esni, F., Ramaswamy, A., Mullendore, M., Buchholz, M., **Maitra, A.**, Feldmann, G. Snail and Sonic Hedgehog activation in neuroendocrine tumors of the ileum. *Endocr Relat Cancer* 14:865-74, 2007
106. Lucito, R., Suresh, S., Walter, K., Pandey, A., Lakshmi, B., Krasnitz, A., Sebat, J., Wigler, M., Klein, A.P., Brune, K., Palmisano, E., **Maitra, A.**, Goggins, M., Hruban, R.H. Copy-Number Variants in Patients with a Strong Family History of Pancreatic Cancer. *Cancer Biol Ther.* 6(10)1592-9, 2007
107. Lee, K.M., Cao, D., Itami, A., Pour, P.M. Hruban, R.H., **Maitra, A.**, Ouellette, M.M. Class III beta-tubulin, a marker of resistance to paclitaxel, is overexpressed in pancreatic ductal adenocarcinoma and intraepithelial neoplasia. *Histopathology* 51(4):539-46, 2007
108. Qian, J., Yong, K.T., Roy, I., Ohulchanskyy, T.Y., Bergey, E.J., Lee, H.H., Tramposch, K.M., He, S., **Maitra, A.**, Prasad, P.N. Imaging pancreatic cancer using surface-functionalized quantum dots. *J Phys Chem B.* 111:6969-72, 2007
109. Karanjawala, Z.E., Illei, P.B., Ashfaq, R., Infante, J.R., Murphy, K., Pandey, A., Schulick, R., Winter, J., Sharma, R., **Maitra, A.**, Goggins, M., Hruban, R.H. New markers of pancreatic cancer identified through differential gene expression analyses: claudin 18 and annexin A8. *Am J Surg Pathol.* Feb;32(2):188-196, 2008
110. Kumar, S.K., Roy, I., Anchoori, R.K., Fazli, S., **Maitra, A.**, Beachy, P.A., Khan, S.R. Targeted inhibition of hedgehog signaling by cyclopamine prodrugs for advanced prostate cancer. *Bioorg Med Chem.*, 16(6):2764-8; 2008
111. Kweil, K.A., Bashyam, M.D., Kao, J., Ratheesh, R., Reddy, E.C., Kim, Y.H., Montgomery, K., Giacomini, C.P., Choi, Y.-L., Chatterjee, S., Karikari, C.A., Salari, K., Wang, P., Hernandez-Boussard, T., Swarnalata, G., van de Rijn, M., **Maitra, A.**, Pollack, J.R. Genomic Profiling Identifies GATA6 as a Candidate Oncogene Amplified in Pancreatobiliary Cancer. *PLoS Genetics* 2008 May 23;4(5):e1000081.
112. Jimeno, A., Tan, A.C., Coffa, J., Rajeshkumar, N.V., Kulesza, P., Rubio-Viqueira, B., Wheelhouse, J., Diosdado, B., Messersmith, W.A., Iacobuzio-Donahue, C., **Maitra, A.**, Varella-Garcia, M., Hirsch, F.R., Meijer, G.A., Hidalgo, M. Coordinated epidermal growth factor receptor pathway gene overexpression predicts epidermal growth factor receptor inhibitor sensitivity in pancreatic cancer. *Cancer Res.* 68:2841-9, 2008
113. An, W., Han, J.S., Schrum, C.M., **Maitra, A.**, Koentgen, F., Boeke, J.D. Conditional activation of a single-copy L1 transgene in mice by Cre. *Genesis.* 2008 Jul 9;46(7):373-383.
114. Park, S.W., Davison, J.M., Rhee, J., Hruban, R.H., **Maitra, A.**, Leach, S.D. (Cover Article) Oncogenic KRAS Induces Progenitor Cell Expansion and Malignant Transformation in Zebrafish Exocrine Pancreas. *Gastroenterology*, 2008 Jun;134(7):2080-90.

Invited Editorials and Reviews

1. Wistuba, I.I., **Maitra, A.**, Albores-Saavedra , J., Gazdar , A.F. Molecular changes in cervical endocrine tumors. *Contemp Obstet Gynecol* 45:25-36, 2000
2. **Maitra, A.**, Wistuba, I.I., Gazdar, A.F. Microdissection and the study of cancer pathways. *Current Molecular Medicine* 1:153-62; 2001.

3. Takaori, K., Hruban, R.H., Maitra, A., Tanigawa, N. Pancreatic Intraepithelial Neoplasia. *Pancreas* 28:257-62; 2004
4. Maitra, A. and Thuluvath, P.J. GP73: A (Golgi) Complex Phenomenon. *Am J Gastroenterol* 99:1096-8, 2004
5. Henke, R., Maitra, A., Paik, S., Wellstein, A. Gene expression analysis in sections and tissue microarrays of archival tissues by mRNA *in situ* hybridization. *Histol Histopathol* 20:225-37; 2005
6. Hruban, R.H., Wilentz, R.E., Maitra, A., Identification and analysis of precursors to invasive pancreatic cancer. *Methods Mol Med.* 103:1-13, 2005
7. Hansel, D.E., Maitra, A., Argani, P. Pathology of the gallbladder: a concise review. *Current Diag Pathol* 2005
8. Maitra, A., Fukushima, N., Takaori, K., Hruban, R.H. Precursors to invasive pancreatic cancer. *Adv Anat Pathol* 12:81-91, 2005
9. Maitra, A., Hruban, R.H. A new mouse model of pancreatic cancer: PTEN gets its Akt together. *Cancer Cell* 8:171-2; 2005
10. Henke, R.T., Kim, S.E., Maitra, A., Park, S., Wellstein, A. Expression analysis of mRNA in formalin-fixed, paraffin-embedded archival tissues by mRNA *in situ* hybridization. *Methods* 38:253-62; 2006
11. Turner, J.R., Maitra, A., Natkunam, Y., Rubin, B.P., Rubin, M.A., Teitel, M.A. Bringing pathobiology into focus. *Lab Invest* 86:632; 2006
12. Takaori, K., Hruban, R.H., Maitra, A., Tanigawa, N. Current topics on precursors to pancreatic cancer. *Adv Med Sci* 51:23-30; 2006
13. Winter, J.M., Maitra, A., Yeo, C.J. Genetics and pathology of pancreatic cancer. *HPB (Oxford)* 8(5):324-36; 2006.
14. Singh, M., Maitra, A. Precursor lesions of pancreatic cancer: molecular pathology and clinical implications. *Pancreatology* 18:9-19; 2007
15. Feldmann, G., Beaty, R.M., Hruban, R.H., Maitra, A. Molecular genetics of pancreatic intraepithelial neoplasia. *J Hepatobiliary Pancreat Surg* 14:224-32; 2007
16. Beaty, R.M., Gronborg, M., Pollack, J.R., Maitra, A. Target discovery and validation in pancreatic cancer. *Methods Mol Biol.* 360:57-89, 2007.
17. Maitra, A. and Hruban, R.H. Pancreatic Cancer. *Annu Rev Pathol Mech Dis.* 3:157-88, 2008.
18. Feldmann, G., Maitra, A. Molecular genetics of pancreatic ductal adenocarcinomas and recent implications for translational efforts. *J Mol Diagn.* Mar;10(2):111-22, 2008. (Cover article)
19. Koorstra, J.B., Feldmann, G., Habbe, N., Maitra, A. Morphogenesis of pancreatic cancer: role of pancreatic intraepithelial neoplasia (PanINs). *Langenbecks Arch Surg.* 2008 Feb 19 [epub ahead of print].

Book Chapters

1. Gazdar A.F. and Maitra, A. Tissue Microdissection and Processing *In Cancer Treatment and Research: Cancer Chemoprevention*; Kluwer Academic Publishers, Norwell, MA, 2001.
2. Gazdar, A.F., and Maitra, A. Molecular Genetics of Human Adenocarcinomas *In Encyclopedia of Genetics*; Academic Press, London, UK, 2001
3. Maitra, A. and Kumar, V. The Respiratory System *In Basic Pathology* 7th Edition; Saunders Publications, Philadelphia. PA, 2003
4. Maitra, A. and Kumar, V. The Endocrine System *In Basic Pathology* 7th Edition; Saunders Publications, Philadelphia. PA, 2003
5. Maitra, A. and Kumar, V. Genetic and Pediatric Disorders *In Basic Pathology* 7th Edition; Saunders Publications, Philadelphia. PA, 2003
6. Maitra, A. and Abbas, A. The Endocrine System *In Kumar, Abbas, Fausto (eds) Robbins' Pathologic Basis of Disease* 7th Edition; Elsevier Health Sciences, Philadelphia, PA, 2004.
7. Maitra, A. and Kumar, V. Diseases of Infancy and Childhood *In Kumar, Abbas, Fausto (eds) Robbins' Pathologic Basis of Disease* 7th Edition; Elsevier Health Sciences, Philadelphia, PA, 2004
8. Iacobuzio-Donahue, C. and Maitra, A. Gene Expression Profiling *In Current Problems in Cancer: Pancreatic Cancer*; Mosby, Inc., St. Louis, MO, 2002.
9. Hruban, R.H., Wilentz, R., Maitra, A. Identification and Analysis of Precursors to Invasive Pancreatic Cancer *In Pancreatic Cancer: Methods and Protocols*, Humana Press, Totowa, NJ, 2004
10. Meeker, A.K., Gage, W.R., DeMarzo, A., Maitra, A. Direct *in situ* assessment of telomere length variation in human cancers and preneoplastic lesions *In Hayat (ed) Handbook of Immunohistochemistry and In Situ Hybridization of Human Carcinomas*, volume 2; Kluwer Academic Publishers, Norwell, MA, 2004.
11. Yeo, C.J., Yeo, T.P., Hruban, R.H., Kern, S.E., Iacobuzio-Donahue, C., Maitra, A., Goggins, M.G., Canto, M.I., Messersmith, W., Abrahms, R., Laheru, D., Hidalgo, M., Jaffee, E.M. Cancer of the Pancreas *In DeVita, Hellman, Rosenber (eds) CANCER: Principles and Practice of Oncology*, Lippincott, Williams, and Wilkins, Philadelphia, PA, 2004
12. Maitra, A. and Kumar, V. Diseases of Infancy and Childhood *In Kumar, Mitchell (eds) Pocket Companion to Robbins' Pathologic Basis of Disease* 7th Edition; Elsevier Health Sciences, Philadelphia, PA, 2005
13. Maitra, A. and Abbas, A. The Endocrine System *In Kumar, Mitchell (eds) Pocket Companion to Robbins' Pathologic Basis of Disease* 7th Edition; Elsevier Health Sciences, Philadelphia, PA, 2005
14. Hruban, R.H., Maitra, A., Kern, S.E. Precursors to invasive cancer of the pancreas *In Nasir (ed) Cancer Growth and Progression*
15. Gronborg, M., Maitra, A. and Pandey A. Proteomics of Human Pancreatic Juice *In Thongboonkerd, V. (ed) Proteomics of Human Body Fluids*, Humana Press, Totowa, NJ, 2006, In press.

16. Kristiansen, T.Z., Maitra, A., and Pandey A. Proteomics of Human Bile *In Thongboonkerd, V. (ed) Proteomics of Human Body Fluids*, Humana Press, Totowa, NJ, 2006, In press.
17. Maitra, A. and Yeo, C.J. Genetics and Molecular Biology of Pancreatic and Biliary Cancers *In Blumgart, L.H. (ed) Surgery of the Liver, Biliary Tract, and Pancreas*, 4th Ed, Elsevier Health Sciences, Philadelphia, PA, 2006
18. Fukushima, N., Maitra, A., Huban, R.H. Pathology of Pancreatic Cancer *In Cameron, J.L., Berger, H.G., Matsuno, S. (eds) Current Surgical Therapy*, 9th Ed, Mosby Press, St. Louis, MO, 2006
19. Maitra, A., Kern, S.E., Hruban, R.H. Molecular Pathogenesis of Pancreatic Cancer *In Ghaneh, P., Neoptolemos, J.P. (ed) Best Practice and Research Clinical Gastroenterology: Pancreatic Cancer*, Elsevier Health Sciences 20:211-26; 2006
20. Beaty, R.M., Gronborg, M., Pollack, J.R., Maitra, A. Target Discovery and Validation in Pancreatic Cancer *In Methods in Molecular Biology: Target Discovery and Validation*, Humana Press, Totowa, NJ, 360:57-89; 2007
21. Maitra, A. and Kumar, V. The Endocrine System *In Basic Pathology* 8th Edition; Elsevier Health Sciences, Philadelphia, PA, 2007
22. Maitra, A. and Kumar, V. The Respiratory System *In Basic Pathology* 8th Edition; Elsevier Health Sciences, Philadelphia, PA, 2007
23. Hruban, R.H., Brune, K., Fukushima, N., Maitra, A. Pancreatic Intraepithelial Neoplasia *In Pancreatic Cancer* (Lowy A. and Leach S.D. eds.) Springer Science and Media, 2008

Scientific Abstracts:

1. Maitra, A., Yashima, K., Timmons, C.F., Shay, J.W., Gazdar, A.F. Expression of the RNA component of human telomerase in neuroblastic tumors in children (Texas Society of Pathologists Residents' Seminar, Corpus Christi, 1997)
2. Maitra, A., Hirany, S., Jialal, I. Comparison of two methods for measuring LDL cholesterol (Texas Society of Pathologists Residents' Seminar, Corpus Christi, 1997)
3. Timmons, C.F., Yashima, K., Maitra, A., Shay, J.W., Gazdar, A.F. Expression of the RNA component of telomerase in Wilms tumors and nephrogenic rests (Society for Pediatric Pathology, 1997)
4. Yashima, K., Milchgrub, S., Ashfaq, R., Maitra, A., Shay, J.W., Gazdar, A.F. High expression of human telomerase RNA during multistage carcinogenesis may predict for imminent invasion (88th American Association of Cancer Research Annual Meeting, San Diego, 1997)
5. Maitra, A., Yashima, K., Timmons, C.F., Shay, J.W., Gazdar, A.F. Expression of the RNA component of telomerase in neuroblastic and non-Wilms' renal tumors in children (Society for Pediatric Pathology Meeting, Minneapolis, 1997)
6. Salahuddin, S., Maitra, A., Timmons, C.F., Gazdar, A.F. Allelotyping nephrogenic rests, the putative precursor lesions of Wilms tumors (Society for Pediatric Pathology Meeting, Toronto, 1998)
7. Maitra, A., Ashfaq, R., Saboorian, M.H., Gokaslan, S.T. Cytohistologic correlation in the primary diagnosis of mesenchymal lesions - the role of FNAB in guiding management (46th American Society of Cytopathology Annual Meeting, Nashville, 1998)

8. Maitra, A., Saboorian, M.H., Gokaslan, S.T., Lindberg, G., Ashfaq, R. Cytohistologic correlation of fine needle aspiration biopsy of salivary gland lesions: a five year experience (88th United States and Canadian Academy of Pathology Meeting, San Francisco, 1999)
9. Maitra, A., Wistuba, I.I., Virmani, A.K., Sakaguchi, M., Park, I., Minna, J.D., Gazdar, A.F. Enrichment of epithelial cells for molecular studies (90th American Association of Cancer Research, Philadelphia, 1999).
10. Park, I., Wistuba, I.I., Maitra, A., Milchgrub, S., Virmani, A.K., Gazdar, A.F. Multiple clonal abnormalities in bronchial epithelium of lung cancer patients (90th American Association of Cancer Research, Philadelphia, 1999).
11. Shivapurkar, N., Sood, S., Wistuba, I.I., Virmani, A.K., Maitra, A., Milchgrub, S., Minna, J.D., Gazdar, A.F. Multiple regions of chromosome 4 affected by loss of heterozygosity in breast carcinomas (90th American Association of Cancer Research Meeting, Philadelphia, 1999)
12. Maitra, A., Rathi, A., Sagalowsky, A., Gazdar, A.F., Ashfaq, R. Expression of the RNA Component of Human Telomerase (hTR) in Cytospin Preparations from Bladder Washings : A Correlative Study with Histology (47th American Society of Cytopathology Annual Meeting, Sacramento, 1999)
13. Lin, W.M., Ashfaq, R., Michalopoulos, E., Maitra, A., Gazdar, A.F., Muller, C. The utility of residual fluid based cervical cytology for comprehensive molecular analyses (AACR Special Symposium on Biology and Genetics of Early Detection and Chemoprevention of Cancer, Bal Harbour, 1999)
14. Shivapurkar, N., Maitra, A., Milchgrub, S., Gazdar, A.F. Deletions of chromosome 4 occur early during the pathogenesis of colon cancer (91st American Association of Cancer Research Meeting, San Francisco, 2000).
15. Maitra, A., Gazdar, A.F., Wistuba, I.I., Ashfaq, R. Correlation of FHIT protein expression with loss of heterozygosity in breast cancer cell lines (89th United States and Canadian Academy of Pathology Meeting, New Orleans, 2000)
16. Washington, C., Wistuba, I., Stuckey, A., Maitra, A., Mele, G., Gazdar, A.F., Minna, J.D. Microdissected breast cancers demonstrate a high frequency of 3p allele loss identifying at least 5 different putative tumor suppressor gene sites (91st American Association of Cancer Research Meeting, San Francisco, 2000).
17. Xu, X.L., Wu, L., Maitra, A., Tomlinson, G.E., Gazdar, A.F., Bowcock, A.M., Baer, R., Minna, J.D. BE2, a BRCA1-interacting protein located at the tumor suppressor locus 11p15.5-p15.4 undergoes epigenetic inactivation in breast and lung cancer (Cold Spring Harbor Symposium, 2000).
18. Maitra, A., Wanzer, D., Weinberg, A.G., Ashfaq, R. Amplification of the Her-2/neu oncogene is uncommon in pediatric osteosarcomas (Society for Pediatric Pathology Meeting Atlanta, 2001)
19. Maitra, A., Roberts, H., Weinberg, A.G., Geraerts, J. Aberrant expression of cell cycle proteins in the Ewing family of tumors (Society for Pediatric Pathology Meeting Atlanta, 2001)
20. Maitra, A., Roberts, H., Weinberg, A.G., Geraerts, J. Aberrant expression of cell cycle proteins in the pediatric osteosarcomas (Society for Pediatric Pathology Meeting Atlanta, 2001)
21. Maitra, A., Weinberg, A.G. Cell cycle abnormalities in juvenile polyps (Society for Pediatric Pathology Meeting Atlanta, 2001)

22. **Maitra, A.**, Chen, T.T., Savla, J., Timmons, C.F., Wyatt-Ashmead, J., Tomlinson, G.E. Mutations of the hSNF5/INI1 gene in choroid plexus carcinomas (Society for Pediatric Pathology Meeting Atlanta, 2001)
23. Wistuba, I.I., Ashfaq, R., **Maitra, A.**, Pimentel, F., Troncoso, P., Alvarez, H., Gazdar, A., Minna, J.D. Chromosome 3p and fhit gene abnormalities in the pathogenesis of gallbladder carcinoma (90th United States and Canadian Academy of Pathology Meeting, Atlanta, 2001)
24. **Maitra, A.**, Tascilar, M., Hruban, R.H., Offerhaus, G.J., Albores-Saavedra, J. Small cell carcinoma of the gallbladder: a clinicopathologic, immunohistochemical and molecular pathology study of twelve cases (90th United States and Canadian Academy of Pathology Meeting, Atlanta, 2001)
25. **Maitra, A.**, Winick, N., Schneider, N.R., Kroft, S.H., McKenna, R.W. Acute lymphoblastic leukemia t(1;19) revisited. (90th United States and Canadian Academy of Pathology Meeting, Atlanta, 2001)
26. Chen, T.T.-L., **Maitra, A.**, Savla, J., Wyatt-Ashmead J, Tomlinson, G.E. Mutational analysis of the hSNF5/INI1 gene in choroid plexus carcinomas and rhabdoid tumors (92nd American Association of Cancer Research Meeting, New Orleans, 2001)
27. Wistuba, I.I., Tang, M., **Maitra, A.**, Alvarez, H., Troncoso, P., Pimentel, F., Minna, J., Gazdar, A.F. Genome-Wide Allelotyping Analysis Reveals Multiple Sites of Allelic Loss in Gallbladder Carcinoma (92nd American Association of Cancer Research Meeting, New Orleans, 2001)
28. Wistuba I., **Maitra A.**, Carrasco R., Tang M., Troncoso T., Alvarez H., Gazdar A., Minna J. Chromosome 3p, 8p, 9q and 22q deletions in the sequential pathogenesis of gallbladder carcinoma (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
29. Harada, K., **Maitra, A.**, Toyooka, S., Mastrangelo, D., Timmons, C.F., Tomlinson, G.E., Gazdar, A.F. Promoter methylation of caspase-8 and rassf1a is a common event in solid tumors of childhood. (Society for Pediatric Pathology Meeting, Chicago, 2002)
30. **Maitra A.**, Wistuba, I. I., Miquel, J.F., Hruban, R.H., Argani, P., Ashfaq, R. Immunohistochemical analysis of cyclooxygenase enzymes in the sequential pathogenesis of gallbladder carcinoma. (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
31. C.A. Iacobuzio-Donahue, **A. Maitra**, G. Shen, K. Berg, K. Walters, S.E. Kern, M.Goggins, R.H. Hruban. Discovery of novel tumor markers of pancreatic cancer using global gene expression technology (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
32. Wilentz R.E, Ashfaq, R., **Maitra, A.**, Dassopoulos, T., Bayless, T.M., Talamini, M.A., et al. Immunohistochemical expression of adenomatous polyposis coli (apc), beta-catenin, and E-cadherin in colitis-associated adenocarcinomas and dysplasias (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
33. **Maitra, A.**, Iacobuzio-Donahue, C.A., Agrani, P., Wilentz, R.E., Cameron, J. L., Yeo, C. J., et al. Expression of mesothelin and prostate stem cell antigen – two novel markers identified by serial analysis of gene expression – in mucinous cystic neoplasms and intraductal papillary mucinous neoplasms of the pancreas. (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
34. Iacobuzio-Donahue, C.A., Brown, P.O., Olsen, M., **Maitra, A.**, Walters, K. Jaffe, E. et al. Exploration of global gene expression of pancreatic cancer by cDNA microarray analysis (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)

35. Maitra, A., Ashfaq, R., Hruban, R.H., Wilentz, R.E. Cyclooxygenase-2 expression in pancreatic adenocarcinomas and pancreatic intraepithelial neoplasia (PanIN) (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
36. Maitra, A., Timmons, C.F., Ilaria, R., Wanzer, D., Ashfaq, R. Amplification of the Her-2/neu oncogene is uncommon in Ewing family of tumors (Society for Pediatric Pathology Meeting, Chicago, 2002)
37. Torbenson, M., Choti, M., Ashfaq, R., Maitra, A., Boitnott, J. B., Wilentz, R. DPC4 over-expression in hepatocellular carcinoma is strongly associated with TGF-Beta-Receptor II Immunolabeling (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
38. McCarthy, D.M., Maitra, A., Rader, A.E., Faigel, D.O., Hruban, R.H., Wilentz, R.E. Utility of Novel Markers of Pancreatic Duct Adenocarcinoma in Fine-Needle Aspiration: Mesothelin and Prostate Stem Cell Antigen Increase Specificity. (91st United States and Canadian Academy of Pathology Meeting, Chicago, 2002)
39. House, M.G., Guo, M.Z., Schulick, R.D., Cameron, J.L., Yeo, C.J., Hruban, R.H., Groth, J., Herman, J.G., Maitra, A., Gerasits, J. Abnormal Expression of Cell Cycle Control Genes in Pancreatic Endocrine Neoplasms. (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
40. Hansel, D.E., Rahman, A., Hruban, R.H., Shulick, R., Thuluvath, P., Ku, J-L., Park, J-G., Gerasits, J., Miyazaki, K., Ashfaq, R., Hidalgo, M., Argani, P., Maitra, A. Identification of Novel Targets in Biliary Tract Cancers Using Global Gene Expression Technology (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
41. Hansel, D.E., Meeker, A.K., Lillemoe, K.D., Shulick, R., Hruban, R.H., Maitra, A., Argani, P. Telomere Length Variation in Biliary Tract Metaplasia, Dysplasia and Carcinoma (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
42. Iacobuzio-Donahue, C.A., Meeker, A.K., Maitra, A., Wilentz, R.E., Kern, S.E., Montgomery, E.A., De Marzo, A. Loss of Telomere Maintenance Is an Early Event in Inflammatory Bowel Disease Related Neoplasia (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
43. Maitra, A., Van Heek, T., Adsay, V., Iacobuzio-Donahue, C., Rahman, A., Goggins, M.G., Wilentz, R.E., Argani, P., Hruban, R.H., Berg, K.D. Global Expression Analysis of Pancreatic and Colorectal Cancers Reveals Cancer-Type Specific Tumor Markers (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
44. Zhang, H., Maitra, A., Tabaczka, P., Wilentz, R.E., Hruban, R.H., Adsay, N.V. Differential MUC1, MUC2 and MUC5AC Expression in Colorectal, Ampullary and Pancreatobiliary Carcinomas: Potential Biologic and Diagnostic Implications (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
45. Cheng, C-C., Chen, Y-C., Maitra, A., Hruban, R.H., Gabrielson, E., Kurman, R.J., Shih, I-M. Apolipoprotein E Expression in Ovarian Serous Carcinoma and Other Types of Cancer (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
46. Hansel, D.E., Rahman, A., Hermans, J., de Krijger, R., Ashfaq, R., Yeo, C., Cameron, J., Hruban, R.H., Maitra, A. Microvascular Density in Pancreatic Endocrine Neoplasms Is Associated with VEGF-C and VEGFR-2 Expression (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)

47. Iacobuzio-Donahue, C.A., Swierczynski, S., **Maitra, A.**, Hruban, R.H. Progressive Loss of Mesothelin Protein Expression with Advanced Metastatic Disease in Patients with Pancreatic Ductal Adenocarcinoma (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
48. Iacobuzio-Donahue, C.A., **Maitra, A.**, Berg, K., Hollingsworth, M.A., Kern, S.E., Goggins, M.G., Hruban, R.H. Exploration of Highly Expressed Genes in Pancreatic Duct Adenocarcinomas Using U133 Oligonucleotide Arrays with Comparisons to Other Global Gene Expression Platforms (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
49. **Maitra, A.**, Hansel, D.E., Rahman, A., Geradts, J., Yeo, C.J., House, M.G., Argani, P., Hruban, R.H. Global Expression Analysis of Pancreatic Endocrine Neoplasms Using Oligonucleotide Microarrays (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
50. Rahman, A., Houlihan, P.S., Iacobuzio-Donahue, C.A., Klimstra, D.S., Zee, S., **Maitra, A.**, Torbenson, M., Hruban, R.H., Abraham, S.C., Wu, T.T., Wilentz, R.E. Microsatellite Instability Occurs in a Subset of Pancreatic Intraductal Papillary Mucinous Neoplasms (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
51. Rahman, A., **Maitra, A.**, Yeo, C.J., Cameron, J.L., Hruban, R.H., Ashfaq, R., Hansel, D.E. p27^{Kip1} Expression in Metastatic and Non-Metastatic Pancreatic Endocrine Neoplasms (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
52. Swierczynski, S.L., Argani, P., Iacobuzio-Donahue, C.A., Ashfaq, R., Cameron, J.L., Yeo, C.J., Rahman, A., Hruban, R.H., **Maitra, A.** Development and Validation of Tissue Microarrays in Pancreatic Cancer (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
53. Swierczynski, S.L., **Maitra, A.**, Abraham, S.C., Iacobuzio-Donahue, C.A., Ashfaq, R., Schulick, R.D., Rahman, A., Yeo, C.J., Hruban, R.H., Argani, P. Identification of Novel Tumor Markers in Biliary Carcinomas Using Tissue Microarrays (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
54. Van Heek, N.T., Meeker, A.K., Kern, S.E., Goggins, M.G., Offerhaus, G.J., Demarzo, A.M., Hruban, R.H., **Maitra, A.** Telomere Shortening Is Nearly Universal in Pancreatic Intraepithelial Neoplasia (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
55. Meeker, A.K., Hicks, J.L., Argani, P., **Maitra, A.**, Iacobuzio-Donahue, C.A., Montgomery, E.A., Westra, W.H., De Marzo, A.M. Direct Evidence of Telomere Shortening in a Wide Range of Human Epithelial Pre-Cancerous Lesions (92nd United States and Canadian Academy of Pathology Meeting, Washington, DC, 2003)
56. Koopmann, J., Fedarko, N., Jain, A., **Maitra, A.**, Iacobuzio-Donahue, C.A., Yeo, C.J., Hruban, R.H., Goggins, M.G. Evaluation of Osteopontin as Biomarker for Pancreatic Adenocarcinoma (Digestive Diseases Week, Orlando, 2003)
57. van Heek, N.T., **Maitra, A.**, Koopmann, J., Fedarko, N., Jain, A., Rahman, A., Iacobuzio-Donahue, C.A., Adsay, V., Ashfaq, R., Yeo, C.J., Cameron, J., Offerhaus, J., Hruban, R.H., Berg, K., Goggins, M.G. Identification of Osteopontin as a serum marker of ampullary carcinoma by gene expression profiling (Digestive Diseases Week, Orlando, 2003)
58. Henke, R. T., **Maitra, A.**, Gvozdjan, D., Tassi, E., McDonnell, K., Wellstein, A. Expression of newly discovered metastasis genes in tissue microarrays of gastrointestinal cancers is predictive of metastasis status (94th American Association of Cancer Research Meeting, Washington, DC, 2003)

59. Rathi, A., Virmani, A., Harada, K., Miyajima, K., **Maitra, A.**, Timmons, C.F., Gazdar, A.F. Aberrant methylation of the HIC1 promoter is a frequent event in specific pediatric neoplasms (94th American Association of Cancer Research Meeting, Washington, DC, 2003)
60. House, M.G., Wistuba, I.I., Argani, P., Guo, M., Schulick, R.D., Hruban, R.H., Herman, J.G., **Maitra, A.** Hypermethylation of tumor suppressor genes in gallbladder cancer (Society of Surgical Oncology Annual Meeting, Los Angeles, 2003)
61. House, M.G., Guo, M.Z., Herman, J. G., Schulick, R.D., Cameron, J.L., Hruban, R.H., **Maitra, A.**, Yeo, C.J. Aberrant hypermethylation of tumor suppressor genes in pancreatic endocrine neoplasms (American Surgical Association Annual Meeting, Washington, DC, 2003)
62. House, M.G., Guo, M.Z., Hooker, C.M., Herman, J.G., Schulick, R.D., Cameron, J.L., Hruban, R.H., **Maitra, A.**, Yeo, C.J. Prognostic value of hMLH1 hypermethylation and microsatellite instability in surgically resected endocrine tumors of the pancreas (American Association of Endocrine Surgeons Annual Meeting, San Diego, 2003).
63. Amador, M. L., **Maitra, A.**, Gruenwald, V., Peralba, J. M., Hidalgo, M. Determinants of resistance to OSI-774 in biliary tract carcinoma cell lines. (American Society of Clinical Oncology Annual Meeting, Chicago, IL 2003)
64. Amador, M. L., Oppenheimer, D., **Maitra, A.**, Embuscado, E., Iacobuzio-Donahue, C., Hidalgo, M. Genetic-based rational combination of Zd1839 and Ci-1040 in biliary tract carcinoma (Gastrointestinal Cancer Symposium, American Society of Clinical Oncology, 2004)
65. Montgomery, E., Zhang, S., Mamelak, A., **Maitra, A.**, Sheikh, S., Amr, S., Yang, S., Brock, M., Forastiere, A., Berg, K. Claudin gene overexpression in esophageal adenocarcinoma and its precursors. (93rd United States and Canadian Academy of Pathology Meeting, Vancouver, British Columbia, 2004)
66. Hansel, D.E., Wilentz, R.E., Yeo, C.J., Schulick, R.D., Montgomery, E., **Maitra, A.** Expression of neuropilin-1 in high grade dysplasia, invasive cancer, and metastases of the human gastrointestinal tract. (93rd United States and Canadian Academy of Pathology Meeting, Vancouver, British Columbia, 2004)
67. **Maitra, A.**, Cao, D., Albores-Saavedra, J., Klimstra, D., Hruban, R.H. Expression of epithelial markers in nonductal neoplasms of the pancreas. (93rd United States and Canadian Academy of Pathology Meeting, Vancouver, British Columbia, 2004)
68. Hansel, D.E., **Maitra, A.**, Lin, J., Yeo, C.J., Leach, S.D., Biankin, A.V. Expression of CDX 1 and 2 distinguishes periampullary lesions by site of origin, tumor stage, metastatic potential, and patient outcome. (93rd United States and Canadian Academy of Pathology Meeting, Vancouver, British Columbia, 2004)
69. Cao, D., Sato, N., **Maitra, A.**, Hruban, R.H., Goggins, M. Expression of two novel epithelial markers -fascin and cystatin c- in intraductal pancreatic mucinous neoplasms (IPMNs) of the pancreas. (93rd United States and Canadian Academy of Pathology Meeting, Vancouver, British Columbia, 2004)
70. Klimstra, D.S., Takaori, K., Hruban, R.H., Adsay, N.V., Albores-Saavedra, J., Biankin, A.V., Biankin, S.A., Compton, C.C., Fukushima, N., Furukawa, T., Goggins, M., Kato, Y., Kloepfel, G., Longnecker, D., Luettges, J., **Maitra, A.**, Offerhaus, G.J., Shimizu, M., Yonezawa, S. Consensus Criteria for the Classification of Pancreatic Intraepithelial Neoplasia (PanIN) and Intraductal Papillary Mucinous Neoplasms (IPMNs). (93rd United States and Canadian Academy of Pathology Meeting, Vancouver, British Columbia, 2004)

71. Prasad, N., Biankin, A.V., Fukushima, N., **Maitra, A.**, Elkahloun, A., Goggins, M.G., Hruban, R.H., Leach, S.D. Pancreatic intraepithelial neoplasia demonstrates features of gastric metaplasia. (Digestive Disease Week, New Orleans, 2004)
72. Kumar, S.K., Roy, I., Denmeade, S.R., Isaacs, J.T., **Maitra, A.**, Khan, S.R. Nanoparticles as novel vectors for targeted drug delivery to prostate cancer. (95th American Association of Cancer Research Meeting, Orlando, FL, 2004)
73. Hansel, D.E., Dhara, S., **Maitra, A.**, Montgomery, E. *CDC2/p34* upregulation and expression in a progression model of esophageal adenocarcinomas. (95th American Association of Cancer Research Meeting, Orlando, FL, 2004)
74. Bashyam, M.D., Kim, Y.K., **Maitra, A.**, Pollack, J.R. Localization of novel pancreatic cancer genes by CGH on cDNA microarrays. (95th American Association of Cancer Research Meeting, Orlando, FL, 2004)
75. Oppenheimer, D., Amador, M.L., **Maitra, A.**, Rahman, A., Perea, S., Cusatis, G.A., Iacobuzio-Donahue, C., Embuscado, E., Baker, S.D., Forastiere, A., Hidalgo, M. Polymorphisms of intron 1 of the epidermal growth factor receptor (EGFR) affects the response to the EGFR tyrosine kinase inhibitor OSI-774. (95th American Association of Cancer Research Meeting, Orlando, FL, 2004)
76. Hingorani, S.R., Petricoin, E.F., **Maitra, A.**, King, C., Jacobetz, M.A., Yoshiya, K., Crawford, H.C., Putt, M.E., Jacks, T., Konieczny, S. F., Wright, C.V., Hruban, R.H., Lowy, A., Tuveson, D.A. Endogenous *KRAS*^{G12D} expression induces pancreatic intraepithelial neoplasia (PanIN) in mice with a definable proteomic signature. (95th American Association of Cancer Research Meeting, Orlando, FL, 2004)
77. Hansel, D., Dhara, S., Huang, R., Deasel, M., Ashfaq, R., Shimada, Y., Bernstein, H., Harmon, J., Brock, M., Forestiere, A., Washington, K., **Maitra, A.**, Montgomery, E. CDC2/CDK1 Expression in Esophageal Adenocarcinoma and Precursor Lesions Serves as a Diagnostic and Cancer Progression Marker and Potential Novel Drug Target (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
78. Montgomery, E., Cunningham, S., Schulick, R., Yeo, C., Haque, R., Hammoud, S., Hustinx, S., Kim, M., Iacobuzio-Donahue, C., Ashfaq, R., Kamangar, F., **Maitra, A.** Identification of Novel Cellular Targets in the Progression Model of Gastric Adenocarcinoma (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
79. Yang, G-Y, Dilworth, H.P., Ashfaq, R., Hruban, R.H., **Maitra, A.** Tissue Transglutaminase II: A Biomarker of Pancreatic Ductal Adenocarcinoma (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
80. Chandrasekharan, A., Shi, C., Thuluvath, P.J., Wistuba, I.I., Karikari, C.A., Argani, P., Goggins, M.G., Eshleman, J.R., **Maitra, A.** Ultrasensitive Detection of KRAS Mutations in Bile and Serum from Patients with Biliary Cancer Using LigAmp Technology (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
81. Hustinx, S.R., Hruban, R.H., Leoni, L.M., Argani, P., Ashfaq, R., Goggins, M.G., Kern, S., **Maitra, A.** Homozygous Deletion of the MTAP Gene in Invasive Adenocarcinoma of the Pancreas and in Periampullary Cancer: A Potential New Target for Therapy (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)

82. Hustinx, S.R., **Maitra, A.**, Leoni, L.M., Ashfaq, R., Goggins, M.G., Iacobuzio-Donahue, C., Kern, S., Hruban, R.H. Concordant Loss MTAP and p16/CDKN2A Expression in Pancreatic Intraepithelial Neoplasia: Evidence of Homozygous Deletion in a Non-Invasive Precursor Lesion (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
83. Hustinx, S.R., Cao, D., Hruban, R.H., Sato, N., Martin, S., Sudhir, D., Iacobuzio-Donahue, C., Kern, S., Goggins, M.G., Pandey, A., **Maitra, A.** Differentially Expressed Genes in Pancreatic Ductal Adenocarcinomas Identified through Serial Analysis of Gene Expression: An Update (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
84. **Maitra, A.**, Cao, D., Lee, K., Itami, A., Hruban, R.H., Ouellette, M. The Tubulin Beta-4 Polypeptide (TUBB4), a Marker of Resistance to Taxanes, Is Overexpressed in Pancreatic Intraepithelial Neoplasia and Pancreatic Ductal Adenocarcinoma (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
85. Zhang, H., Basturk, O., Othman, M., Cheng, J.D., Khayyata, S.H., **Maitra, A.**, Hruban, R.H., Adsay, N.V. Expression of MUC1, MUC2, MUC5AC and CDX2 in Carcinomas of the Gallbladder and Extrahepatic Bile Duct (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
86. Cao, D., Kassaui, K., Argani, P., Neumann, C., Ho, L., Abbruzzese, J., Ouellette, M., **Maitra, A.** Expression of Two Novel Tumor Markers, Maspin and Tubulin beta Polypeptide (TUBB), in Biliary Cancers (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
87. Henke, R.T., Kim, S.E., Fang, W.J., **Maitra, A.**, Wellstein, A. Outcome in Patients with Colorectal Adenocarcinoma in Relation to the Expression of the Growth Factor Pleiotrophin and Its Receptor Anaplastic Lymphoma Kinase (Poster presentation at the 94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
88. Powell, E.L., Montgomery, E., Leoni, L., **Maitra, A.** Concordant Loss of MTAP and p16/CDKN2A Expression in Barrett Esophagus and Adenocarcinoma: Evidence of Homozygous Deletion in Non-Invasive Precursor Lesions (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
89. **Maitra, A.**, Cao, D., Neumann, C., Abbruzzese, J., Ho, L. Aberrant Expression of Maspin in Idiopathic Inflammatory Bowel Disease Is Associated with Disease Activity and Neoplastic Transformation (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
90. Salaria, S., Cronin, M., Kim, E., Zhang, Q., **Maitra, A.**, Neumann, C., Hruban, R.H., Goggins, M.G., Abbruzzese, J., Ho, L. Maspin Is Overexpressed in the Majority of Pancreatic Ductal Adenocarcinomas and Pancreatic Intraepithelial Neoplasia (PanIN) Lesions: A Potential Biomarker for Early Detection (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
91. Hansel, D.E., **Maitra, A.**, House, M.G., Yeo, C.J., Ali, S.Z. Differential Expression of Neuroendocrine Markers in Liver Metastases of Cancers of Unknown Primary (94th Annual Meeting of the United States and Canadian Academy of Pathology, San Antonio, Texas, March 2005)
92. Rubio-Viqueira, B., Jimeno, A., Iacobuzio-Donahue, C., **Maitra, A.**, Bouraoud, N., Yeo, C., Altik, S., Hidalgo, M. Novel *in vivo* model for drug development in pancreas cancer (96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 2005)

93. Hansel, D.E., Wehner, S., Herzog, V., **Maitra, A.** Alterations in Gene Expression in Pancreatic Cancer Cell Lines Induced by the N-terminal Fragment of APP (sAPP) (96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 2005)
94. Shi, C., Chandrashekharan, A., Thuluvath, P.J., Wistuba, I.I., Karikari, C., Argani, P., Goggins, M.G., **Maitra, A.**, Eshleman, J.R. Ultrasensitive Detection of KRAS2 Mutations in Bile and Serum from Patients with Biliary Cancer using LigAmp Technology (96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 2005)
95. Mullendore, M.E., Fan, X., Eberhart, C., Matsubayashi, H., Ouellette, M., Li, Y., **Maitra, A.** Notch signaling in pancreas cancer (Late-breaking abstract at the 96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 2005)
96. Kumar, S., Roy, I., **Maitra, A.**, Beachy, P., Khan, S.R. Targeted inhibition of hedgehog signaling by cyclopamine prodrug for advance prostate cancer (Late-breaking abstract at the 96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 2005)
97. Rakheja, D., Leos, N., Mullendore, M., **Maitra, A.**, Margraf, L. Mutation of Mitotic Spindle Checkpoint Gene BUB1B in Mosaic Variegated Aneuploidy (Joint Meeting of the Society for Pediatric Pathology/Pediatric Pathology Society, Tours, France, September 2005)
98. Brune, K.A., Abe, T., Canto, M.I., O'Malley, L., Klein, A.P., **Maitra, A.**, Adsay, N.V., Fishman, E., Cameron, J.L., Yeo, C.J., Kern, S.E., Goggins, M.G., Hruban, R.H. Multifocal Neoplastic Precursor Lesions Associated with Lobular Atrophy of the Pancreas in Patients Having a Strong Family History of Pancreatic Cancer (Poster presentation at the 95th Annual Meeting of the United States and Canadian Academy of Pathology, Atlanta, Georgia, February, 2006)
99. Cao, D., Adsay, N.V., **Maitra, A.**, Antonescu, C., Klimstra, D., Hruban, R.H. Expression of c-kit in Solid Pseudopapillary Tumor of the Pancreas (Poster presentation at the 95th Annual Meeting of the United States and Canadian Academy of Pathology, Atlanta, Georgia, February, 2006)
100. Zhou, S., Kassaei, K., Poeta, M.L., Cutler, D.J., Koch, W., Sidransky, D., **Maitra, A.**, Califano, J. Detection of mitochondrial DNA mutations in head and neck cancers (Poster presentation at the 97th Annual Meeting of the American Association for Cancer Research, Washington, DC, April 2006)
101. Kristiansen, T., Gronborg, M., Harsha, H.C., Goggins, M.G., **Maitra, A.**, Pandey, A. Quantitative proteomics for identification of membrane proteins as biomarkers for pancreatic cancer (Poster presentation at the 97th Annual Meeting of the American Association for Cancer Research, Washington, DC, April 2006)
102. Weekes, C.D., Rubi-Viquera, B., Zhang, X., Jimeno, A., **Maitra, A.**, Hidalgo, M. Stromal derived factor 1 alpha mediates resistance to mTOR inhibition by the preservation of hypoxia inducible factor 1 alpha expression (Platform presentation at the 97th Annual Meeting of the American Association for Cancer Research, Washington, DC, April 2006)
103. Jimeno, A., Rubio-Viquera, B., Peralba, J., Zhang, X., Bouraoud, N., Cusatis, G., Chan, A., Singh, S., Hirsch, F., Mills, G., Kuleszka, P., Altio, S., Iacobuzio-Donahue, C., **Maitra, A.**, Hruban, R., Hidalgo, M. Combined targeted therapy shows increased efficacy in a novel in vivo pancreas cancer model (Poster presentation at the 97th Annual Meeting of the American Association for Cancer Research, Washington, DC, April 2006)

104. Jagadeeswaran, R., Ahmed, S., Janamanchi, V., Surawska, H., Karikari, C., **Maitra, A.**, Salgia, R. c-met Receptor tyrosine kinase: a novel molecular therapeutic target for the treatment of pancreatic cancer (Poster presentation at the 97th Annual Meeting of the American Association for Cancer Research, Washington, DC, April 2006)
105. Hidalgo, M., Rubio-Viqueira, B., Weekes, C., Song, D., Shah, P., Messersmith, W., Messersmith, W., Altiock, S., Kulesza, P., **Maitra, A.**, Jimeno, A. (Platform presentation at the 2006 ASCO Annual Meeting)
106. Rubio-Viqueira, B., Mezzadra, H., Iacobuzio-Donahue, C., Jimeno, A., Zhang, X., **Maitra, A.**, Altiock, S., Hidalgo, M. Optimizing targeted agents development in pancreatic cancer: A fine-needle aspirate biopsy (FNAB) based ex vivo and in vivo assay (Platform presentation at the 2006 ASCO Annual Meeting)
107. Alvarez, H., Riggins, G., Roa, J.C., Diaz, A., Pimentel, F., Ibanez, L., **Maitra, A.**, Corvalan, A.H. Serial analysis of gene expression identifies novel candidate markers for gallbladder cancer (Poster presentation at the 2007 ASCO Gastrointestinal Cancers Symposium)
108. Krizman, D., Darfler, M., **Maitra, A.**, Hood, B., Conrads, T. Proteomic identification of biomarkers of precursor lesions of pancreatic cancer (Poster presentation at the 98th Annual Meeting of the American Association for Cancer Research, Los Angeles, CA, April 2007)
109. Alvarez, H.A., Corvalan, A., Argani, P., Roa, J.C., Diaz, A., Pimentel, F., Ibañez, L., Riggins, G., **Maitra, A.** Transcriptomic profiling in a multiethnic gallbladder cancer study identifies novel candidate genes for targeted therapy (Poster presentation at the 98th Annual Meeting of the American Association for Cancer Research, Los Angeles, CA, April 2007)
110. Tsuji, K., Yang, M., Jiang, P., **Maitra, A.**, Kausha, S., Yamauchi, K., Katz, M.H., Moossa, A.R., Hoffman, R.M., Bouvet, M. Common bile duct injection as a novel method for establishing RFP-expressing human pancreatic cancer in nude mice (Poster presentation at the 98th Annual Meeting of the American Association for Cancer Research, Los Angeles, CA, April 2007)
111. Kwei, K.A., Bashyam, M., **Maitra, A.**, Van de Rijn, M., Montgomery, K., Pollack, J.R. Role of SMURF1 amplification in pancreatic oncogenesis (Poster presentation at the 98th Annual Meeting of the American Association for Cancer Research, Los Angeles, CA, April 2007)
112. Karanjawala, Z.E., Illei, P.B., Ashfaq, R., Infante, J., Murphy, K., **Maitra, A.**, Goggins, M., Hruban, R.H. New Markers of Pancreatic Cancer Identified through Differential Gene Expression (Poster presentation at the 96th Annual Meeting of the United States and Canadian Academy of Pathology, San Diego, CA, March 2007)
113. Cheung, W.L., Krizman, D.B., Alvarez, H., Hood, B.L., Darfler, M.M., Veenstra, T.D., Mollenhauer, J., Habbe, N., Feldman, G., **Maitra, A.** Application of a Global Proteomic Approach to Archival Precursor Lesions: Upregulation of DMBT-1 and TG2 in Pancreatic Cancer Precursors (Poster presentation at the 97th Annual Meeting of the United States and Canadian Academy of Pathology, Denver, CO, March 2008)
114. Hristov, A.C., Di Cello, F., Delos Reyes, M., Singh, M., Smail, S., Karikari, C.A., **Maitra, A.**, Resar, L.M.S. Expression of High Mobility Group A (HMGA1) Proteins in Pancreatic Ductal Adenocarcinoma (PDA). (Poster presentation at the 97th Annual Meeting of the United States and Canadian Academy of Pathology, Denver, CO, March 2008)

Patents and Inventions:

1. Novel diagnostic markers and therapeutic target for pancreatic cancer (International Application WO 03/030725)
2. EGFR polymorphism type predicts response to inhibitors of the EGFR (Patents pending)
3. Tumor markers for pancreatic endocrine neoplasms (Patents pending)
4. Widespread requirements for ligand stimulated Hedgehog pathway activity in growth of digestive tract tumors (Patents pending)
5. Genes overexpressed in pancreatic cancer as identified by a re-examination of the SAGE database (Patents pending)
6. Biocompatible "smart" nanogels as carriers for hydrophobic drugs (Patents pending)

EXTRAMURAL SPONSORSHIP**ACTIVE**

R01 CA113669 (Maitra)

04/01/05-03/31/10

2.4 calendar

NIH/NCI

\$197,500

Hedgehog Inhibitors in Pancreas cancer

The Specific Aims of the R01 are as follows: (1) Determine the effects of Hh pathway blockade in orthotopic xenografts derived from human pancreatic cancer using cyclopamine; (2) Study the role of Hh pathway in a syngeneic mouse model of pancreatic adenocarcinoma; (3) Determine predictive biomarkers of resistance and sensitivity to Hh inhibitors in pancreatic cancers.

Role: P.I.

R01 CA119397 (Prasad, SUNY at Buffalo)

09/01/05-08/31/10

.12 calendar

NIH/ NCI

\$212,002

Multifunctional nanoparticles in diagnosis and therapy of pancreatic cancer

The objective of this project is to develop hybrid ceramic-polymeric nanoparticles that can be utilized for targeted imaging and drug delivery in pancreas cancer.

Role: P.I. Subcontract

R01 CA112016 (Pollack, Stanford University)

04/01/06-03/31/11

.24 calendar

NIH

\$52,856

Gene Amplification and Deletion in Pancreatic Cancer

The specific aims of this project are 1) To identify and map at high resolution gene amplifications and deletions in pancreatic cancer; 2) To identify the "driver" oncogene/TSG(s) within localized regions of CAN; and 3) To determine the functional role of novel oncogenes/TSGs in pancreatic cancer development or progression.

Role: P.I. Subcontract

Merck (Maitra)

12/01/06-11/30/08

.12 calendar

Contract

\$184,272

Notch inhibitors in Human Pancreatic Cancer

The goal of this project is to determine the therapeutic efficacy of small molecule Notch inhibitors in preclinical xenograft models of pancreatic cancer.

Role: P.I. Contract

2P50 CA062924 (Kern) NIH SPORE in Gastrointestinal Cancer (Project 3C)	07/01/07-06/30/12 \$7,946,234	1.92 calendar
The goal of this project is to identify the genetics of precursor lesions of pancreatic cancer and develop biomarkers for biological classification and risk stratification in these lesions.		
Role: P.I. Subproject		
Sign Path Pharma, Inc. (Maitra) Contract Preclinical Evaluation of Nanocurcumin in Pancreatic Cancer	09/18/07-09/17/08 \$100,000	.12 calendar
The goal of this project is to evaluate the therapeutic effects of polymeric nanoparticle encapsulated curcumin (nanocurcumin) in xenograft models of pancreatic cancer.		
Role: P.I. Contract		
Novartis, Corp. (Maitra) Contract Evaluation of single agent and combination LDE ₂₂₅ in preclinical models of pancreatic cancer	07/01/08-06/30/09 \$91,861	.12 calendar
The goal of this project is to evaluate a new orally bioavailable Hedgehog inhibitor in pancreatic cancer.		
Role: P.I. Contract		
R21CA122265 (Eshleman) NIH/NCI Novel tumor suppressor gene discovery in pancreatic cancer	04/01/07-03/31/09 \$100,000	.48 calendar
The goal of this project is to functionally identify tumor suppressor genes using whole genome shRNA libraries.		
Role: co-P.I.		
N/A (Maitra) Lustgarten Foundation Targeting the Herpes Virus Entry Mediator (HVEM) as a novel therapeutic strategy in pancreatic cancer	01/01/08-12/31/08 \$88,950	0.6 calendar
The goal of this project is to test the approach that HVEM is a valid therapeutic target in pancreatic cancer, and that blockade of the HVEM – BT LA interaction will result in restitution of cytotoxic T cell activation in the tumoral milieu and result in tumor growth inhibition, using conditional models of HVEM activation <i>in vivo</i> .		
Role: P.I.		
R01 CA134767 (Nelkin) NIH Targeting CDK5 in Pancreatic Cancer: Mechanistic and Preclinical Development	07/01/08-06/30/13 \$250,000	2.4 calendar
The goal of this project is to develop CDK5 as a potential therapeutic target for the control of pancreatic cancer.		
Role: co-P.I.		
<u>COMPLETED</u>		
LF01-009 (Maitra) Lustgarten Foundation for Pancreatic Cancer Research Genetic basis of familial pancreatic cancer: a novel approach using whole genome conversion and oligonucleotide microarrays	01/01/02 –12/31/03	
The objective of this study was to examine somatic cell hybrids from patients with familial pancreatic cancer to detect germline mutations in the mono-chromosomal milieu, using HuSNP gene chips.		
Role: P.I.		

P50 CA62924 Pilot Project (Maitra) NIH/NCI SPORE in Gastrointestinal Cancer Development of a human mitochondrial genome sequencing microarray (MITOChip) as a universal tool for cancer detection The objective of this study was to develop a sequencing microarray for detection of mitochondrial mutations in cancers and in clinical samples from cancer patients. Role: P.I.	04/01/02-06/30/03
N/A (Maitra) National Pancreas Foundation The Familial Pancreatic Cancer Gene Chip: Designing a high-throughput sequencing microarray for risk assessment in familial pancreatic cancer The objective of this study was to develop a sequencing microarray for germline mutation detection in familial pancreatic cancer kindred. Role: P.I.	04/01/02-03/31/03
LF03-33 (Pollack) Lustgarten Foundation for Pancreatic Research Locating novel pancreatic cancer genes with cDNA microarrays The objective of this project was to perform comparative genomic hybridization on cDNA microarrays using genomic DNA from pancreatic cancer cell lines and xenografts in order to detect deletions and amplifications. Role: Co-P.I.	01/01/03 -12/31/04
N/A (Maitra) Cancer Research and Prevention Foundation Serum-based biomarkers in biliary tract cancers The objective of this project was to develop serum ELISA for biomarkers identified using microarray-based gene expression analysis of biliary cancers Role: P.I.	01/01/03 - 01/31/05
Johns Hopkins Clinician Scientist Award (Maitra) Johns Hopkins School of Medicine Oncogenic pathways in biliary cancers The objective of this study is to identify and target oncogenic signaling pathways in biliary cancers, for potential mechanism based therapies. Role: P.I.	07/01/04 - 04/30/05
RFA04-040 (Maitra) Lustgarten Foundation for Pancreatic Research Hedgehog Inhibitors in Pancreas Cancer This grant was rescinded due to overlap with R01CA113669-01 Role: P.I.	07/01/04 - 05/31/05
R21/R33 CA107858-01 (Maitra) NIH/NCI A sequencing microarray for mitochondrial mutations The objective of the study is to determine the feasibility of using mitochondrial mutations in pancreatic juice as a biomarker for pancreas cancer. Role: P.I.	04/01/04-11/30/05

N/A (Maitra) Maryland Cigarette Restitution Fund Comprehensive array-based analysis of somatic mitochondrial mutations in smoking-related gastrointestinal tract cancers The objective of this study is to determine the frequency of somatic mitochondrial mutations in smoking-associated gastro-esophageal and colorectal cancers arising in African American patients. Role: P.I.	01/01/04-12/31/05
AACR-PanCAN Career Development Award (Maitra) Notch Signaling in Pancreatic Cancer. The specific aims are 1) To characterize the <i>in vitro</i> effects of individual Notch receptors (Notch 1-3) on growth of neoplastic and non-neoplastic pancreatic epithelial cell lines; 2) To characterize the <i>in vitro</i> effects of individual Notch ligands (Jagged and the Delta-like ligand DLL1) on growth of neoplastic and non-neoplastic pancreatic epithelial cell lines; and 3) To determine the <i>in vivo</i> effects of pharmacological or genetic manipulation of the Notch pathway in pancreatic cancer cells. Role: P.I.	07/01/04-06/30/06
R21 CA109283-01 (Hidalgo) NIH/NCI Pharmacogenomics of Erlotinib. The objective of this study is to develop pharmacogenomic determinants of Erlotinib activity. Role: Co-Investigator	01/01/05-12/31/06
N/A (Mendell) Lustgarten Foundation The role of microRNA's in the pathogenesis of pancreatic cancer. The objective of this project is to identify abnormally expressed microRNAs in human pancreatic cancers, and their functional consequences. Role: Co-Investigator	01/01/06-12/31/06
Lustgarten Foundation (Maitra) Synergistic targeting of the apoptotic machinery in pancreatic cancer The objective of this proposal is to utilize small molecule inhibitors of X-linked IAP protein in combination with death receptor agonist antibodies as a novel experimental therapy for pancreatic cancer. Role: P.I.	01/01/07-12/31/07
Lustgarten Foundation (Eshleman) Pancreatic Cancer Tumor Suppressor Gene Discovery Using Rnai The goal of this project is to discover new tumor suppressor genes for pancreatic cancer using a RNAi library-based approach. Role: co-P.I.	01/01/07-12/31/07
N/A (Khan) Flight Attendant Medical Research Institute Inhibition of Hedgehog Signaling by Cyclopamine Prodrug for Prostate Cancer The goal of this project is to develop prodrugs of cyclopamine that can be cleaved by PSMA, and to test these in prostate cancer xenograft models. Role: co-P.I.	07/01/07-06/30/10

1R21 DK072532 (Maitra)

08/01/05-07/31/08

NIH/NIDDK

Hedgehog signaling in pancreatic neoplasia

The objective of this study is to determine the role of Hedgehog signaling in exocrine pancreatic injury/repair and neoplasia using a novel transgenic mouse model of ectopic Hedgehog overexpression.

Role: P.I.

TEACHING: University of Texas Southwestern Medical Center**Clinical Instruction****Residency Training**

Pediatric Autopsy and Placental Pathology 1999-2000 Prosector Est. ~150 hours

Classroom InstructionMedical School (2nd Year Pathology Course) 1997-2001 Lab. Instructor 20 hours/year**TEACHING: The Johns Hopkins University School of Medicine****Clinical Instruction:****Pathology Residency and Fellowship Training**

GI/Liver Pathology (on-scope training) 2002- Attending ~200 hours/yr

Gastroenterology Fellowship Training

GI/Liver Pathology (on-scope training) 2001- Attending 2 hours / year

Classroom Instruction:**Medical School (2nd Year Pathology Course)**

Pathology Group V (Neoplasia, GI Tract) 2001- Lab. Instructor 20 hours / year

Impact of Genomics in Medicine 2003- Lecturer 1 hour / year

(Introductory lecture to Pathology lecture series)

Cellular Injury and Adaptation 2005- Lecturer 2 hours/year**Residency and Fellowship Teaching Rounds**

Endocrine Neoplasms of the GI Tract 2003- Lecturer 2 hours / year

Pediatric Disorders

Graduate Program in Pathobiology

Classic Papers in Hepatobiliary Diseases 2003- Lecturer 2 hours / year

Classic Papers in Apoptosis 2005- Lecturer 1 hour/year

Fundamentals of Clinical Oncology for Public Health Professionals (School of Public Health)

Controversies in Pancreatic Cancer 2005 Lecturer 1 hour/year

CME Instruction:1st Annual Current Topics in GI Pathology 2001 Lecturer 1 hour2nd Annual Current Topics in GI Pathology 2002 Lecturer 1 hour3rd Annual Current Topics in GI Pathology 2003 Lecturer 1 hour4th Annual Current Topics in GI Pathology 2004 Lecturer 1 hour5th Annual Current Topics in GI Pathology 2005 Lecturer 1 hour6th Annual Current Topics in GI Pathology 2006 Lecturer 1 hour7th Annual Current Topics in GI Pathology 2007 Lecturer 1 hour

Mentoring

Donna Hansel, MD, PhD	2002-03	Post-doctoral Trainee; 5/03-Recipient of Pathology Young Investigator Award
Surajit Dhara, PhD	2003-04	Residency Research Advisor
Indrajit Roy, PhD	2003-05	Postdoctoral trainee
Guo-Ping Sui, MD	2003-05	Postdoctoral trainee, (International Collaborative Genetics Training Program, NIH)
Sharon Swierczynski, MD, PhD	2003	Residency Research Advisor; 5/03- Recipient of Pathology Young Investigator Award
Denfeng Cao, MD, PhD	2003-04	Residency Research Advisor
Eric Powell, MD	2004	Clinical/Research Fellowship
Robert Beaty, PhD	2004-06	Postdoctoral trainee
Arjun Chandrasekharan	2004	Pre-collegiate summer student; Research resulted in Platform presentation at USCAP Annual Mtg. (San Antonio, 2005)
Georg Feldmann, MD	2005-	Postdoctoral trainee
Hector Alvarez, MD	2005-	Predoctoral trainee, (Registered for PhD with Catholic University, Santiago, Chile)
Marcelo Reyes Marcelo Del Reyes	2005, 2006	Howard Hughes Summer Internship (University of Guam)
Gang-Ming Zou, PhD	2006-	Postdoctoral trainee
Savita Bisht, PhD	2006-	Postdoctoral trainee
Kwang Hyuck Lee, MD	2006-08-	Postdoctoral trainee
Nils Habbe, Ph.D.	2007	Postdoctoral trainee
Jan-Bart Koorstra	2007	Visiting medical student
Ji Kon Ryu	2007	Postdoctoral trainee

CLINICAL ACTIVITIES**Certification:**

Fellow, American Board of Pathology (2001)

Licensure

Maryland Board of Physicians D0057031 Expires 09/2009

Service Responsibilities

Gastrointestinal Mucosal Biopsy Pathology service 20% service commitment

ORGANIZATIONAL ACTIVITIES**Professional Memberships:**

1997-	United States and Canadian Academy of Pathology
1998-2004	Society for Pediatric Pathology
2002-03	American Gastroenterological Association
2002-	American Society for Investigative Pathology
2003-	American Association for Cancer Research
2002	American Society for Clinical Oncology

Editorial Activities:

- Associate Editor, *Current Molecular Medicine* (2000-2006)
Section Editor, *Laboratory Investigation* (2006 -)
Editor-in-Chief, *Current Molecular Medicine* (2006-) (**Impact Factor 4.94**)
Editorial Board, *Pancreatology* (2007-)

Ad-hoc reviewer for peer reviewed publications:

American Journal of Pathology, American Journal of Surgical Pathology, Cancer Research, Clinical Cancer Research, Oncogene, American Journal of Gastroenterology, Journal of Surgical Oncology, World Journal of Surgical Oncology, Journal of Molecular Diagnostics, Oncology (Karger), International Journal of Gastrointestinal Cancer, Journal of Clinical Pathology, Gastroenterology, British Journal of Cancer

Ad-hoc reviewer for study sections and granting agencies:

1. National Institutes of Health Study Sections:

- a. Ad Hoc reviewer, National Cancer Institute Special Emphasis Panel on Centers for Cancer Nanotechnology Excellence ZCA1 GRB-S (CCNE) 2005
- b. Ad Hoc reviewer, National Cancer Institute Oncology Fellowship ZRG1 F09S 2006
- c. Ad Hoc reviewer, National Cancer Institute Drug Discovery and Molecular Pharmacology (DMP) study section, June, 2006
- d. Ad Hoc reviewer, National Cancer Institute Basic Mechanisms of Cancer Therapy (BMCT) study section, June 2007
- e. Ad Hoc Reviewer, National Cancer Institute Special Emphasis Panel ZRG1 ONCS 02
- f. Ad Hoc Reviewer, National Cancer Institute Special Emphasis Panel Cancer Biology and Therapy ZRG1 ONC-U (92)
- g. Ad Hoc Reviewer, National Cancer Institute Special Emphasis Panel Molecular Tumorigenesis ZRG1 ONC-K (03)
- h. Ad Hoc Reviewer, National Cancer Institute Special Emphasis Panel 2008/10 ZRG1 ONC-S (03) M

2. Non-federal Granting Agencies

- a. Italian Association for Cancer Research (AIRC) (2004-05)
- b. Irish Research Council for Science, Engineering and Technology (IRCSET) EMBARK Initiative (2005)
- c. Pancreatic Cancer Action Network (PanCAN) Pilot Grant Awards Review Committee 2008
- d. Scientific Advisory Board Member, Michael Rolfe Foundation for Pancreatic Cancer Research 2007- present

Institutional commitments:

Cellular and Molecular Medicine Oral Exam Committee, October 2005 (Harshan Pisharath, CMM candidate)
Thesis Committee, David Wang (CMM candidate)

Co-Director, 6th Annual Current Topics in GI Pathology, October 2006
Co-Director, 7th Annual Current Topics in GI Pathology, November 2007

RECOGNITION

Awards

- | | |
|------|---|
| 1997 | Texas Society of Pathologists John D Rainey Memorial Award |
| 1997 | Society for Pediatric Pathology Gordon Vawter Award |
| 1999 | American Society of Cytopathology Warren R Lang Award |
| 2000 | Society for Pediatric Pathology Lotte Strauss Award |
| 2001 | Society for Pediatric Pathology Harry Neustein Award |
| 2001 | Best Small Group Teaching Award , UT Southwestern Sophomore Course |
| 2004 | United States and Canadian Academy of Pathology Benjamin Castleman Award |

- 2006 Maryland Outstanding Young Scientist Award (Allan C. Davis Medal)
2007 Eugene Di Magno Presidential Award for Junior Faculty, American Pancreatic Association
2008 Ramzi Cotran Young Investigator Award, United States and Canadian Academy of Pathology

Invited Lectures

1. Molecular mechanisms involved in PanIN progression towards invasive pancreatic adenocarcinoma at the Annual Meeting of the Japanese Forum for Carcinoma in Situ of the Pancreas, Nagoya, Japan, October 2002.
2. Molecular genetics of pancreatic intraepithelial neoplasia at the Arizona Cancer Center, Tucson, AZ, November, 2002.
3. Diseases of the Pancreas at Georgetown University Medical School (Pathology Sophomore Course), Georgetown, DC, March 2003.
4. Sequencing the human mitochondrion using CustomSeq resequencing microarrays at the European Society of Human Genetics Symposium Affymetrix Users Group Meeting, Birmingham, UK April 2003.
5. Sequencing the human mitochondrion using CustomSeq resequencing microarrays at the American Society of Human Genetics Symposium Affymetrix Users Group Meeting, Los Angeles, October 2003.
6. Emerging concepts: Pancreatic cancer pathogenesis at "Meet the Professor" Session, American Society of Clinical Oncology Annual meeting, New Orleans, June 2004
7. Biliary tract cancer: molecular pathogenesis and cellular targets at the International Workshop in Biliary Tract Cancer, Shanghai, China, July 2004 (organized by NCI Division of Cancer Epidemiology and Genetics).
8. Pancreatic Intraepithelial Neoplasia at the Sidney Kimmel Comprehensive Cancer Center Translational Research Conference, Johns Hopkins University, September 2004
9. Pancreatic Cancer 2005: Advances and Challenges at the 94th Annual Meeting of the United States Canadian Academy of Pathology Advanced Molecular Pathology Course, San Antonio, March 2005
10. Pancreatic Intraepithelial Neoplasia at Yale University Department of Pathology Grand Rounds, March 2005
11. Towards Effective Management of Pancreatic Cancer: New Concepts in Organ Site Research at the 96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 2005
12. Molecular Correlates of Pancreatic Intraepithelial Neoplasia at the American Gastroenterology Association's Digestive Diseases Week, Chicago, May 2005
13. Familial Pancreatic Cancer at the Annual Meeting of the Lustgarten Foundation for Pancreatic Cancer Research, Memorial Sloan Kettering Cancer Center, New York, June, 2005
14. Pathogenesis of Biliary Tract Cancer at Yonsei University, Seoul, South Korea, August, 2005
15. Anatomic Pathology Visiting Professor Lecture Series at the University of Texas Southwestern Medical Center, Dallas, Texas, August 2005
16. Monitoring Genomic stability in human embryonic stem cells (Affymetrix Webinar), October 31, 2005
17. Pancreatic Cancer 2006 at Department of Pathology, Northwestern University School of Medicine, Chicago, January 2006
18. Pancreatic Cancer: Advances and Challenges at Uniformed Services University of the Health Sciences/United States Military Cancer Institute Joint Symposium, Bethesda, March 2006
19. Novel Molecular Approaches for Early Detection of Pancreatic Cancer at the Annual Meeting of the Lustgarten Foundation for Pancreatic Cancer Research, University of North Carolina, Chapel Hill, June 2006
20. Morphogenesis of Pancreatic Cancer – the role of PanIN lesions at the International Meeting of Cancer of the Pancreas, Ulm, Germany, September 2006
21. Pancreatic cancer: strategies for early detection and prevention at the 2006 AACR Frontiers in Cancer Prevention and Research Conference, Washington, DC November 2006
22. Developmental Signaling Pathways in Pancreatic cancer at Cardinal Bernadin Cancer Center, Loyola University School of Medicine, February 2007
23. Developmental Signaling Pathways in Pancreatic cancer at University of California San Francisco, San Francisco, March 2007
24. Molecular Pathogenesis of Pancreatic cancer at Digestive Disease Week, Washington DC, May 2007

25. A functional assay for pancreatic cancer stem cells at American Pancreatic Association-Lustgarten Foundation for Pancreatic Cancer Research Special Symposium on Pancreatic Cancer Stem Cells, Chicago, November 2007
26. New therapeutic targets for Pancreatic Cancer at the Han-Mo Koo Memorial Seminar Series at Van Andel Research Institute, Grand Rapids, Michigan, April 2008
27. Pancreatic Cancer 101 at the Pancreatic Cancer Action Annual Advocacy Day, Washington, DC March 2008
28. Pancreatic Cancer 2008 at the Department of Pathology Grand Rounds at Georgetown University Medical Center, Washington DC, March 2008
29. New Therapeutic Targets for Pancreatic Cancer at Lombardi Cancer Center Visiting Professor Series, Georgetown University Medical Center, Washington DC, May 2008
30. New Therapeutic Targets for Pancreatic Cancer at the Pancreatic Cancer Research Team Annual Meeting (Keynote Speaker), American Society of Clinical Oncology, Chicago IL, May 2008

APPENDIX B

Drip Column References

1. Innova Biosciences Protocol

a. Section 2.5.3 Elution step last paragraph

“If a drip column format is used, the displacer is allowed to pass into the column bed and the flow is then halted (e.g. by capping the column outlet). After a period of equilibration (15-30 minutes) the dissociated proteins are flushed out by application of more elution buffer. This step can be repeated until protein is absent from the eluted fractions.”

2. U.S. Patent No.: 5,336,412

a. Background of the Invention

“Conventional gel-chromatography “drip” columns...”

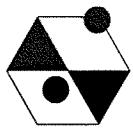
3. Thermo Scientific

a. Product catalog description

“The easy-to-use Zeba Spin Format dramatically improves results over standard drip-column methodologies, eliminating the need to wait for samples to emerge by gravity flow and the need to monitor fractions for protein recovery.”

4. CDNA Library Protocols by Ian G. Cowell & Caroline A. Austin, Humana Press, p 46, Published 1996: ISBN:089603383X

a. Drip column preparation.



GTP-agarose resin (γ -phosphate-linked):

Low substitution (1-2 $\mu\text{mol}/\text{ml}$)

High substitution (>6 $\mu\text{mol}/\text{ml}$)

Release 002; Jan 2005

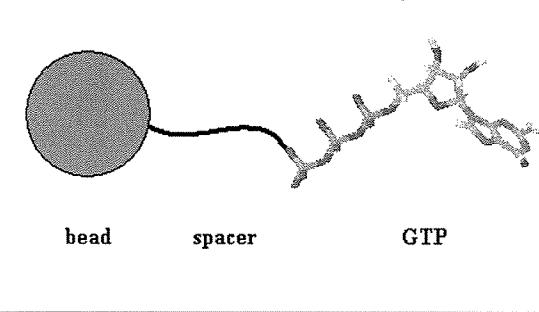
Technical bulletin 261

1. INTRODUCTION

Affinity resins have been widely used for the purification of enzymes and other proteins that bind nucleotides and related molecules.

GTP-agarose resin comprises GTP attached to agarose beads via its γ -phosphate. Two forms of the resin are available with low and high ligand substitution. A long hydrophilic spacer (14-atom) is used to minimise unwanted hydrophobic interactions and to facilitate unhindered interactions with biomolecules. The ligand is coupled through the γ -phosphate group which means that the resin is resistant to phosphatases found in many crude tissue extracts.

Fig 1 Schematic diagram of GTP agarose



2. INSTRUCTIONS

2.1. Storage of GTP agarose resin

The resin is supplied as 50% (v/v) slurry in 10mM Tris/300 mM NaCl/1mM EDTA, pH 8.0. The product is shipped at ambient temperature but should be stored at 4°C upon arrival.

2.2. Materials required (but not supplied)

For small sample volumes you may need only a microfuge and 1.5 ml tubes. For larger volumes (up to 20 ml) purification of binding proteins is conveniently carried out using disposable polypropylene columns. A simple mixing device (e.g. rotary shaker or end-over-end mixer) may also be useful.

2.3. Overview of procedure

GTP-agarose resin is added to a crude protein extract and the suspension is gently mixed. After a period of incubation the resin is transferred to a disposable column and washed to remove non-bound or loosely adsorbed material. Finally, the column is eluted with buffer containing a competing ligand.

Since GTP-agarose resin may capture more than one type of GTP-binding protein the instructions below provide only general guidance on the use of resin. You may need to modify the conditions to facilitate the binding of your particular biomolecule of interest.

2.4 Buffers

For simplicity we would recommend that you start with the same buffer for the equilibration, binding and wash steps. The elution buffer is prepared by adding a competing ligand.

2.4.1 Types of buffers

The buffer and pH must be compatible with the biomolecule of interest. Tris (pH 7.5-8.5) and Hepes (pH 7.0-8.0) are commonly used but other buffers may also be suitable.

2.4.2 Metal ions

Binding proteins often recognise metal ion-nucleotide complexes rather than free nucleotide. It may be necessary therefore to include MgCl₂ or other suitable metal salt (usually at least 10 mM) in column buffers to facilitate metal-dependent interactions with the resin.

2.4.3 Salts

To prevent non-specific electrostatic interactions with the matrix it is usual to include 100mM–500mM NaCl, KCl or other salt in the buffer.

2.4.4 Thiols

Thiols are often included in buffers to prevent oxidation of cysteine residues. A final concentration of 1 mM DTT is commonly used. DTT is not stable and should be added to the buffer immediately before use.

2.4.5 Protease inhibitors

Protease inhibitors (e.g. PMSF, benzamidine) may or may not be required, depending on the sensitivity of the protein of interest to proteolysis. It is also advisable to carry out the binding and wash steps in a cold room or fridge using ice-cold buffers.

2.4.6 Detergents

Detergents (e.g. Triton X-100) are sometimes used to prevent non-specific hydrophobic interactions. Since the resin and spacer are hydrophilic a detergent may not be necessary. However, if a detergent is required try relatively low concentrations (0.02-0.1%) in the first instance.

2.5 Chromatography steps

Make sure the resin has been fully equilibrated with the column equilibration buffer before commencing the purification procedure. Dialyse or desalt the sample into the same buffer before application to the resin.

2.5.1 Binding step

If you do not have access to an automated chromatography system, a batch-binding method may be used. Protein samples with volumes of 0.5-1.0 ml should be incubated in 1.5ml tubes

with 50-100 µl of agarose resin. For larger sample volumes the incubation should be carried out in 10 ml, 30 ml or 50 ml tubes (or in a capped disposable column with an integral upper reservoir). Allow at least 1 hour at 4°C for binding to take place, and agitate the sample at regular intervals to prevent settling of the resin.

If you have a pump system the recommended flow rate in the first instance is 0.1-0.25 ml/min for columns that are 1-5ml in size though, you may wish to explore higher flow rates especially if the volume of material to be processed is large.

2.5.2 Wash step

If incubations have been carried out in small tubes, the resin should be subjected to five or more cycles of washing and centrifugation (e.g. in a microfuge for 3-4 seconds) using ice-cold buffers. On a larger scale it is easier to transfer the suspension to a disposable polypropylene column and to allow the non-bound material to drip through under the force of gravity. Add the wash buffer carefully down the inner surface of the column and try not to disturb the resin otherwise the wash buffer will mix with the non-bound material, leading to less efficient washing of the resin. It is important to remove all of the non-bound material prior to elution. The absence of protein in the washes is easily verified with a dye-based protein detection reagent (e.g. Bradford reagent) or with a UV monitor.

2.5.3 Elution step

It is important to appreciate in affinity chromatography that the eluting ligand (competing ligand or ‘displacer’) does not usually drive the bound protein from the resin; rather, it associates with proteins that dissociate from the resin and prevents their rebinding. The concentration of the displacer has to be sufficiently high to compete with any unoccupied ligand sites on the resin and sufficient time has to be allowed for dissociation to take place. Resins with a high ligand density (8-12 µmol/ml; 8-12 mM) may need a higher concentration of competing ligand for efficient elution than resins with a low density (1-2 µmol/ml; ~1-2 mM). If GTP is employed as the competing ligand a concentration in the range 5-10 mM is a useful starting point.

For experiments carried out in 1.5 ml tubes, the elution buffer (0.25-1.0 ml) is added to the resin.

After >30 minutes the resin is centrifuged and the supernatant fraction is carefully removed. If a drip column format is used, the displacer is allowed to pass into the column bed and the flow is then halted (e.g. by capping the column outlet). After a period of equilibration (15-30 minutes) the dissociated proteins are flushed out by application of more elution buffer. This step can be repeated until protein is absent from the eluted fractions. If a pump is available the column can be eluted using continuous flow at a rate of 0.05-0.1 ml/min, but it may be necessary to reduce the flow rate (or switch off the pump for a period of time) to ensure that the protein elutes in a relatively small volume.

2.5 Column regeneration

After each run, wash the column with a neutral buffer containing 1M NaCl and then re-equilibrate with 10 mM Tris/300 mM NaCl, 1 mM EDTA pH 8.0. Do not wash the column with strong acid or base. For long-term storage add a preservative (e.g. 0.1% sodium azide).

3. Ordering information

504-0002	2 ml* low ligand density
504-0005	5 ml* low ligand density
505-0001	1 ml* high ligand density
505-0002	2 ml* high ligand density

* packed volume

For bulk quantities or other densities of ligand please contact our customer service department.



DOCUMENT CENTER [HIDE](#)

- [Certificate of Analysis](#)
- [Instruction Books](#)
- [MSDS](#)
- [Print This Page](#)
- [Email This Page](#)
- [Request A Catalog](#)

USER PROFILE [HIDE](#)

Email:
Address:
Password:

[LOG IN](#)

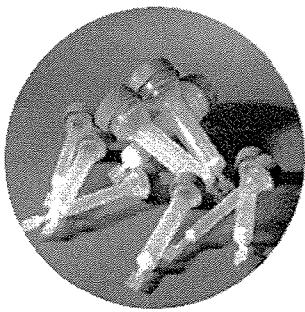
[I Forgot My Password](#)

[New User Registration](#)
[Why Register?](#)

SHOPPING CART [HIDE](#)

- [Ordering Information](#)
 - [Shipping Info](#)
 - [Credit Info](#)
 - [Returns Info](#)
- [Current Order](#)
 - [Currently Empty](#)
 - [Order Form](#)

Zeba Spin Desalting Columns



Why desalt protein samples using cumbersome methods that deliver mediocre results?

Desalt sample volumes ranging from 2 µl to 4 ml with Zeba Desalting Columns and experience exceptional protein recovery quickly

Although numerous techniques and resins for desalting are available, most have many drawbacks, including significant sample loss, long processing times and the need to collect multiple fractions. Zeba Desalting Columns* provide excellent protein recovery without the limitations associated with other desalting methods. With the introduction of Zeba Desalting Columns in 2, 5 and 10 ml formats to complement the Micro and 0.5 ml versions, the Zeba Desalting family of products allows processing of samples volumes ranging from 2 µl to 4 ml (Table 1).

The easy-to-use Zeba Spin Format dramatically improves results over standard drip-column methodologies, eliminating the need to wait for samples to emerge by gravity flow and the need to monitor fractions for protein recovery. Zeba Desalting Columns require no chromatographic system, cumbersome column preparation or equilibration and they can process multiple samples in ~8 minutes.

Zeba Desalting Columns contain a proprietary high-performance desalting resin, exclusive to Pierce, that offers exceptional desalting and protein-recovery characteristics compared to other commercially available resins (Figure 1). Samples containing as low as 25 µg/ml of protein can be processed, providing exceptional protein recovery and ≥ 95% retention of salts and other small molecules (< 1,000 MW). Zeba Spin Desalting Columns are recommended for processing compounds > 7,000 MW.

Highlights:

- Exceptional protein recovery
- No screening fractions for protein or waiting for protein to emerge by gravity flow
- Wide product offering accommodates your sample needs
- Easy-to-use with no cumbersome column preparation or equilibration
- Minimal sample dilution
- Available in formats such as spin columns and chromatography cartridges

Table 1. Recommended sample volumes for Zeba Spin Columns.

Resin Bed	Sample Volume	Zeba Part #
75 µl (micro) column	2-12 µl	89877
0.5 ml column	30-130 µl	89882
2 ml column	200-700 µl	89889
5 ml column	500-2,000 µl	89891
10 ml column	1,500-4,000 µl	89893

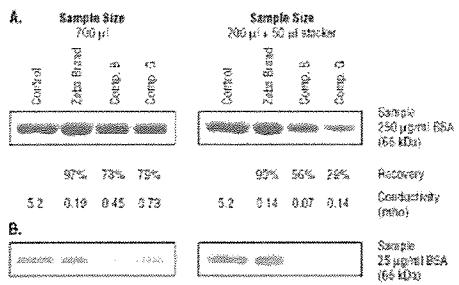


Figure 1. Increased protein recovery with Zeba Spin Desalting Columns. Samples of bovine serum albumin (BSA) at Figure 1A, 250 µg/ml and Figure 1B, 25 µg/ml in 1 M NaCl were desalting with the 2 ml Zeba Desalting Columns and other commercial desalting resins using similar formats. A portion of the recovered sample (10 µl) was analyzed by SDS-PAGE. The remaining sample was used for conductivity measurements and BCA Protein Assay* (Product # 23225) to determine protein concentration. Zeba Desalting Resin provides significantly greater protein recovery under all conditions tested. Conductivity and protein recovery values after desalting are indicated for 250 µg/ml samples.

Related Products

Pierce Centrifuge Columns (empty)

Zeba Micro Desalting Columns

Zeba Spin Desalting Columns, 0.5 ml

* BCA Technology is protected by U.S. patent # 4,839,295. U.S. patent pending on Zeba Micro Column Technology.

Ordering Information

Buy	Product #	Description	Certificate of Analysis	Instruction Book with Protocols	MSDS
			Pkg. Size	Files	Price
Add	89882	Zeba Spin Desalting Columns, 0.5 ml	25/pack		\$97.00
Add	89889	Zeba Spin Desalting Columns, 2 ml for 200 - 700 µl samples	5 columns		\$38.00
Add	89890	Zeba Spin Desalting Columns, 2 ml for 200 - 700 µl samples	25 columns		\$176.00
Add	89891	Zeba Spin Desalting Columns, 5 ml for 600 - 2,000 µl samples	5 columns		\$49.00
Add	89892	Zeba Spin Desalting Columns, 5 ml for 600 - 2,000 µl samples	25 columns		\$222.00
Add	89893	Zeba Spin Desalting Columns, 10 ml for 1,500 - 4,000 µl samples	5 columns		\$59.00
Add	89894	Zeba Spin Desalting Columns, 10 ml for 1,500 - 4,000 µl samples	25 columns		\$265.00
Add	89934	Pierce Chromatography Desalting Cartridges See page for all Pierce Chromatography Cartridges	5 x 1 ml		\$138.00
Add	89935	Pierce Chromatography Desalting Cartridges See page for all Pierce Chromatography Cartridges	5 x 5 ml		\$158.00
Add	89883	Zeba Spin Desalting Columns, 0.5 ml	50/pack		\$176.00

Thermo Fisher Scientific Inc.

Learn more about other Thermo Scientific Life Science Research Products

© 2008 Thermo Fisher Scientific Inc. and its subsidiaries.

PO Box 117, Rockford, IL 61105 USA
1-800-874-3723 or 815-968-0747

PRIVACY STATEMENT



US005336412A

United States Patent [19]

Huse et al.

[11] Patent Number: 5,336,412

[45] Date of Patent: Aug. 9, 1994

[54] PUSH COLUMN CHROMATOGRAPHY METHOD

[75] Inventors: William D. Huse, Del Mar; Anthony M. Sorge, La Jolla; Keith V. Sylvester, San Diego, all of Calif.

[73] Assignee: Stratagene, La Jolla, Calif.

[21] Appl. No.: 84,534

[22] Filed: Jun. 28, 1993

Related U.S. Application Data

[60] Division of Ser. No. 827,995, Jan. 30, 1992, which is a continuation of Ser. No. 292,808, Jan. 3, 1989, abandoned.

[51] Int. Cl. 5 B01D 15/08

[52] U.S. Cl. 210/635; 210/656; 536/25.4

[58] Field of Search 536/25.4; 210/635, 656, 210/198.2, 416.1, 472; 604/187, 190, 191; 436/161, 178; 422/70, 100, 101; 73/864.16, 864.17, 864.18, 864.81, 864.82, 864.83, 864.85, 864.86, 864.87

[56] References Cited

U.S. PATENT DOCUMENTS

- | | | | |
|-----------|--------|----------|-----------------|
| 3,493,503 | 2/1970 | Mass | 604/190 |
| 3,810,545 | 5/1974 | Filz | 210/198.2 |
| 3,902,849 | 9/1975 | Barak | 210/198.2 |
| 4,138,474 | 2/1979 | Updike | 424/1 |
| 4,168,147 | 9/1979 | Acuff | 436/161 |
| 4,214,993 | 7/1980 | Forsythe | 210/198.2 |
| 4,270,921 | 6/1981 | Graas | 210/198.2 |
| 4,341,635 | 7/1982 | Golias | 210/198.2 |

4,388,272	6/1983	Gesteland 422/102
4,414,857	11/1983	Brazhnikov et al. 73/863.11
4,732,672	3/1988	Kiang 210/198.2
4,750,373	6/1988	Shapiro 73/864.87
4,766,082	8/1988	D'Autry 436/178
4,787,971	11/1988	Donald 210/198.2
4,929,427	5/1990	Guala 422/100
5,186,839	3/1993	Kimura 210/656

FOREIGN PATENT DOCUMENTS

- | | | | |
|------------|---------|----------------|-----------------|
| WO89/12229 | 12/1989 | Japan | 210/198.2 |
| 2115717A | 9/1983 | United Kingdom | 210/198.2 |

OTHER PUBLICATIONS

Lehnninger, "The Molecular Basis of Cell Structure and Function"; Biochemistry, 2nd Edition; The Johns Hopkins University, School of Medicine; pp. 158-161.

Manlatis, et al., "Molecular Cloning, A Laboratory Manual", Cold Spring Harbor Laboratory 1982; pp. 109-112, 197-199, 464-467.

Derwent WPI Abstract of Su Pat. 1,182,385 dated Sep. 30, 1985, single page reference.

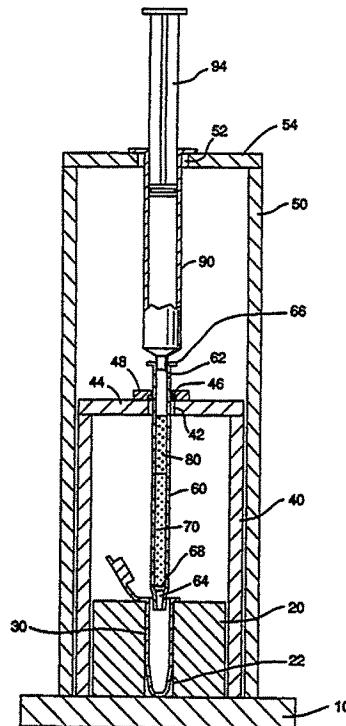
Primary Examiner—Ernest G. Therkorn
Attorney, Agent, or Firm—Limbach & Limbach

[57]

ABSTRACT

A method for chromatography of DNA, RNA, proteins and other molecules includes the use of a column adapted to hold a chromatography material and a sample to be filtered. A pneumatic pressure differential is applied across the column and the sample is urged through the chromatography material. A selected portion of the sample may then be collected.

3 Claims, 2 Drawing Sheets



PUSH COLUMN CHROMATOGRAPHY METHOD

This application is a divisional of allowed application Ser. No. 07/827,995, filed Jan. 30, 1992, which is a continuation of application Ser. No. 07/292,808, filed Jan. 3, 1989, now abandoned.

BACKGROUND OF THE INVENTION

1. Field Of The Invention

The present invention relates to an apparatus and methodology for the chromatography of materials, and in particular, chromatography based on molecular size, affinity and the like as used, for example, in the purification, separation or isolation of DNA and RNA fragments, proteins and other molecules.

2. Background Art

Removing unincorporated nucleotides from DNA and RNA fragments, isolating RNA fractions, purifying proteins and other macromolecules, are important procedures having a variety of applications. In DNA and RNA synthesis, unincorporated nucleotides must often be removed when constructing nick-translated probes, RNA probes and end-labeled oligonucleotides, as well as "filled-in" DNA fragments. It is important to separate the unincorporated free-nucleotides from the labeled probe as unincorporated label may bind to the solid support, resulting in unacceptably high levels of background noise. Isolation of RNA fractions may be employed in the separation of, for example, polyadenylated RNA from nonpolyadenylated RNAs. The use of chromatography methods to isolate and identify proteins and other macromolecules is another well known application.

Current chromatography methods, used particularly in connection with DNA and RNA synthesis, include ion-exchange chromatography, several variations of gel chromatography and others. Each has its own disadvantages. For example, ion-exchange methods require a number of steps which may result in a significant investment of time and, in the case of radiolabeled nucleotide filtering, extensive handling of radioactive material. Conventional gel-chromatography "drip" columns are tedious, requiring time to both pour and run. Spin columns, a variation of the "drip" column, are somewhat faster, but risk radiation exposure and contamination in the case of radionucleotide chromatography, and may yield less reliable results.

An alternative chromatography approach which avoids the aforementioned difficulties would therefore be desirable.

SUMMARY OF THE INVENTION

The present invention is directed to an apparatus and method for purifying, isolating and separating materials using gel chromatography. To that end, a chromatography material and a sample may be loaded into a column and pneumatic pressure applied to urge the sample through the chromatography material, whereby portions of the sample may be collected by the chromatography material and other portions excluded. In one embodiment, a positive pneumatic pressure is provided and in a second embodiment a negative pressure is applied. Additionally, a novel support structure may be employed to support the column during chromatography. The sample may thus be quickly and reliably treated.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an exploded perspective view of an apparatus constructed in accordance with the present invention comprising a column, pressure inducing means, a collection vial and associated support structure.

FIG. 2 is a cross-sectional view of the apparatus of FIG. 1 in a loaded position.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, a chromatography apparatus constructed in accordance with the present invention comprises a generally disk shaped base 10 having a pair of retainers 12 and a generally cylindrical vial holding assembly 20 mounted thereon. Centrally located in the vial holding assembly 20 is a cylindrical chamber 22 for supporting a collection vial 30, into which the eluent from the column may be collected. The vial 30 may be a decapped Eppendorf tube or other suitable collection means. Removably mounted to the base 10, and slideably engaging the exterior wall of the vial holding assembly 20, is a generally cylindrical column support assembly 40. The column support assembly 40 includes a central aperture 42 formed in the generally planar upper surface 44 thereof. As shown in FIG. 2, the support assembly may have a resilient collar 46, such as an "O" ring or the like, positioned circumferentially adjacent the aperture 42, and a collar retainer 48 adapted to retain the collar 46 adjacent the aperture 42. Alternatively, as shown in FIG. 1, the collar 46 and the retainer 48 may be eliminated.

Optionally, a generally cylindrical pressure inducing means support assembly 50 may be removably mounted on the base 10. The support assembly may comprise a central aperture 52 formed in the generally planar upper surface 54 thereof, and is configured to slideably engage the exterior wall of the column support assembly 40. The aperture 52 is preferably axially aligned with the aperture 42 in the column support structure 40, which itself is preferably axially aligned with the chamber 22 in the vial holding assembly 20.

Alternatively, as shown in FIG. 1, the support assembly 50 may include an upper surface 54 having no aperture therein. The support assembly 50 may be further provided with a pair of locking tabs 56 adapted to engage the retainers 12 on the base 10 to lock the support assembly 50 in place during use. Other suitable locking mechanisms, such as threads, could also be employed. The assemblies 20, 40 and 50 may be formed of a radiation shielding material or, preferably, are constructed to fit securely inside a beta shield device. Molded plastic materials have been found suitable although other materials may also be employed.

Supported by the column holding assembly 40 above the vial 30 is a substantially tubular chromatography column 60. The column 60 may be about 1 ml in size, having a preferred internal diameter of about 5 mm and a preferred length of about 100 mm, and comprises openings 62 and 64, respectively, at each end thereof. An annular lip 66 may be provided circumferentially adjacent the upper opening 62, as shown in FIG. 1. The upper opening 62 is adapted to receive a chromatography material 70 and a sample 80 to be filtered. The lower opening 64 has an area of reduced cross-section adapted to prevent passage of the chromatography material 70 while permitting passage of the sample 80. Additionally, a screen or filter 68, comprising, for ex-

7. Size Fractionation

There are many types of filtration media used to separate DNA molecules. Sephadryl S-500 medium separates efficiently in the 2-kb size range. Drip columns made with Sephadryl S-500 medium separate by size, the larger cDNA molecules eluting from the column first and the small unligated adapters and incorporated nucleotides eluting later. The cDNA will not have a high number of counts, but will be detectable by a handheld monitor at ≤ 250 cps.

7.1. Drip-Column Preparation

1. Discard the plunger from a 1-mL plastic syringe, and insert a small cotton plug. Push the cotton to the bottom of the syringe.
2. Fill the syringe to the top with Sephadryl S-500 filtration medium.
3. Place the syringe in a rack and allow the column to drip "dry."
4. Fill the syringe up to ~ 0.5 cm from the top with medium, and drip through as in step 3.
5. Rinse the column with four aliquots of 300 μ L of 1X STE buffer (total wash volume of 1200 μ L). Drip dry after each addition of buffer.

7.2. Collecting Fractions

1. Pipet the cDNA into the washed Sephadryl S-500 drip column, and allow to drip through. This is fraction 1. The recovery volume is ~ 150 μ L and does NOT contain cDNA (see Note 6).
2. Load two more aliquots of 150 μ L of 1X STE buffer on the column and drip through. These are fractions 2 and 3.
3. Collect fraction 4 in a fresh tube. Load 150 μ L of 1X STE buffer and drip as before.
4. Collect fraction 5 as in step 3. Two fractions are usually adequate. The size of the cDNA decreases. Two fractions are usually adequate. The size of the cDNA decreases in each additional fraction. Most of the radioactivity will remain in the column owing to unincorporated nucleotides. Discard the radioactive drip column appropriately.
5. Remove 5 μ L from each fraction (or up to $\frac{1}{10}$ of the fraction volume) for analysis of cDNA size on a 5% nondenaturing acrylamide gel. These aliquots can be frozen at -20°C .
6. To remove any residual enzyme from previous reactions, phenol-chloroform/chloroform extract (see Note 5).
7. Add twice the volume of 100% (v/v) ethanol to precipitate the cDNA.
8. Place on ice for 1 h or at -20°C overnight.

8. Quantitating the cDNA

1. Microcentrifuge the fractionated cDNA at maximum speed for 30–60 min at 4°C . Carefully transfer the ethanol to another tube, and monitor with a Geiger counter. Most of the counts should be present in the pellet. Discard the ethanol appropriately.

From *Methods in Enzymology*, Vol. 100, pp. 103–116.
Copyright © 1983 by Academic Press, Inc.